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ENGINEERING AND EQUIPMENT

No. 30

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USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

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EXPERIMENTAL INVESTIGATION OF THE GEOMETRY OF A SPUTTERING JET OF A SECONDARY LIQUID IN A SUPERSONIC DRIFTING STREAM

Ufa TRUDY UFIMSKOGO AVIATSIONNOGO INSTITUTA [Works of Ufa Aviation Institute] in Russian No 96, 1975 pp 46-52

KLEVANSKIY, V. M.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9B1045 from the author]

[Text] The author gives the experimental dependences on the depth of penetration, form and dimensions of the cross section of a sputtering jet of water during perpendicular injection in a drifting supersonic stream of gas with $M_\infty = 2.5$, $T_\infty^* = 500°K$, $p_\infty^* = 6.9$ bar, at pressures of injection of $p_j = 4-82$ bar and diameters of the nozzle of $dj = 2.36-5.1$ mm. The investigation was conducted by photographing on an IAB-451 instrument and measuring the fields of total pressures. The obtained results demonstrate that the relative dynamic pressure of the liquid $\overline{q}_j$ is an important determining criterion for describing the propagation of the secondary liquid in a supersonic drifting stream. References 5.

USSR UDC 532.526

ARTIFICIAL TURBULIZATION OF THE BOUNDARY LAYER DURING FLOW AROUND MODELS BY A SUPERSONIC CURRENT

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 128-132

PRIDANOV, V. G. and KHARITONOV, A. M.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9B147 by R. A. Safiullin]

[Text] Experiments were conducted in T-313 and T-325 wind tunnels in the range of Mach numbers $M = 2-4$ and unit Reynolds numbers $Re = (13-70)\cdot 10^6$ m^{-1}. The authors present the empirical dependences of the zone of transition on the height of the turbilizer. They found that in the given range of flow parameters it is the sand strip which most effectively turbulizes the boundary layer. The authors investigate the influence of the angle of glide along the trailing edge of the plates, of the sweepback and of the relative thickness of the triangular wings on the effectiveness of the artificial turbulization.

USSR UDC 533.6.011

SYSTEM OF METHODS FOR COMPUTING STEADY-STATE AXISYMMETRIC FLOWS OF IRRADIATING GAS

Moscow DINAMIKA IZLUCHAYUSHCHEGO GAZA [Dynamics of an Irradiating Gas] in Russian No 2, 1976 pp 3-15

SHMYTLEVSKIY, YU. D.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9B195 by G. Ye. Starchenko]

[Text] The author gives a brief survey of works in which methods have been suggested for computing the equations of the dynamics of an irradiating gas in the case of a local thermodynamic equilibrium and absence of scattering. He notes that the universal methods of computing the general problem are not in existence at the present time, therefore computations are made using iteration approximations. In the case of computing stationary flows of an irradiating gas all known iteration processes utilize the division of the system of equations into a subsystem with a known value of Q -- the influx of radiant heat toward the particle of gas and a subsystem with known gas-dynamic parameters (pressure, velocity, temperature). Integration of the equations of transport of radiation and computation present an independent problem connected with a number of computational problems caused by the real properties of the irradiating media (selectivity of radiation, large optical thicknesses and others). The author describes models and gives assumptions and the areas of application of the developed methods by allowing for the real properties of irradiating media. The author gives the most promising, in his opinion, numerical methods (the method of spherical harmonics, for computing the fields of radiation and the Godunov method and characteristics for computing the gas-dynamic field of steady-state subsonic and supersonic currents), however he states that the limited possibilities of computers do not always allow in full measure realizing the desirable accuracy of the computations. References 35.

USSR UDC 533.6.011

HYPERSONIC FLOWS AROUND THIN BODIES

VSESOYUZNYY SIMPOZIUM PO METODAM AEROFIZICHESKIKH ISSLEDOVANII [All-Union Symposium on Methods of Aerophysical Investigations] in Russian, Theses of Reports, 26-29 Apr 76 p 151

BELOLIPETSKIY, V. M.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9B196 from the texts]

[Text] The author examines the problem of flow around thin bodies of a hypersonic stream of nonviscous gas. The equations, describing the three-dimensional steady-state flows of gas, are written in a semigodetic system of coordinates. The author introduces dimensional coefficients which characterize the orders of magnitude of the terms in the equations. In the process of modeling, associated with the various limiting transitions, the author obtains asymptotic forms of the equations of gas dynamics. He determines the parameters of similarity for flows near pointed thin bodies. In approximation of a thin shock layer he finds the computational formulas which permit approximately computing the flow around thin bodies at a small angle of attack and the flow around thin bodies with a break in the generatrices. He constructs an approximate solution to the problem of flow around thin blunt bodies. The entire field of flow is divided into three characteristic regions. By joining the approximate solutions for these regions the author determines the flow near thin blunt bodies. Comparison of the obtained results with the numerical solutions and experiment shows that the suggested approximate solution properly reflects the qualitative picture of the flow around thin blunt bodies by a hypersonic current and permits obtaining satisfactory quantitative results.

USSR UDC 533.6.011

ON THE FORM OF THE PERTURBED ZONE DURING FLOW AROUND OBSTACLES ON A WALL BY A SUPERSONIC CURRENT OF GAS

Ufa TRUDY UFIMSKOGO AVIATSIONNOGO INSTITUTA [Works of the Ufa Aviation Institute] in Russian No 96, 1975 pp 15-18

SHAYKHUTDINOV, Z. G., NADYRSHIN, A. YA., and KLEVANSKIY, V. M.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9B197 by the authors]

[Text] The authors give the results of an experimental investigation on the form of the perturbed zone during three-dimensional flow around blunt half-cylinders and half-cones lying directly on a flat plate or away from it because of backings. The Mach number of the oncoming current $M_\infty = 2.5$. References 5.

USSR UDC 536.248.2:621.176

ON THE PROBLEM OF DESCRIBING THE FLOW FIELD IN THE MIXING CHAMBER OF AN INJECTOR

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 31, No 5, 1976 pp 788-793 manuscript received 14 Apr 75

PRODOV, V. F.

[Abstract] For the description of the flow in the mixing chamber a three-continuum model is used in which the parameters of the liquid jet core and of the liquid are distinguished in the mixing zone. The methods of two-phase continuum mechanics are used to close the equations for the flow field. Two graphs show a comparison of the prediceted and experimental data on the axial profile of the static pressure and Mach number for a fluid. The comparison could be improved if the condensation at the surface of the jet were taken into account. Ill 2; Biblio 10.

USSR UDC 536.242:532.526.2

STUDY OF THE SOLUTIONS OF THE LAMINAR BOUNDARY-LAYER PROBLEM FOR SMALL TEMPERATURE FACTORS AND HIGH MACH NUMBERS

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 31, No 5, 1976 pp 850-856 manuscript received 5 Aug 75

POLYAK, YE. I.

[Abstract] Results are given of a numerical integration of the equation for a non-gradient laminar boundary layer with small temperature factors and high Mach numbers. It is shown that a calculation of the heat-transfer and friction parameters by the "determining" temperature method gives a good coincidence with the exact calculations with and without injection. Some engineering and mathematical considerations are made regarding the advisability of applying intensive injection for hypersonic spacecraft. Ill 3; Biblio 2.

USSR UDC 533.697

AEROMETRIC AND WEIGHT METHODS OF DETERMINING THE CHARACTERISTICS OF HYPERSONIC AIR INTAKES

Novosibirsk VSESOYUZNYY SIMPOZIUM PO METODAM AEROFIZICHESKIKH ISSLEDOVANII [All-Union Symposium on Methods of Aerophysical Investigations, Collection of Works] in Russian, Texts of Reports, 26-29 Apr 76 pp 100-101

GONCHARUK, P. D. and GURYLEV, V. G.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B1023 from the texts]

[Text] The authors investigate change in the structure of a flow at the input and in the neck of supersonic and hypersonic air intakes. They show that for large M numbers of the stream at the input the perturbation of the flow coming from the depths of the channel (antipressure) is transmitted along the boundary layer in the neck far ahead against the flow, producing separations of the boundary layer on the central body and shell. The authors note a large nonuniformity and nonsymmetry of the flow in the cross sections of the channel at the beginning of the neck, as well as nonstationarity of the flow. By allowing for the structure of the flow at the input and in the neck the authors analyze aerometric and "weight" methods of determining the parameters of an averaged supersonic flow in the neck ($M_n > 1$). The investigations were conducted in the range of numbers M = 3-9 and numbers $Re_{d0} = (7.2-0.6)\cdot 10^6$ on heat-insulating models with an input diameter d_0 = 160-60 mm. They evaluated the accuracy of determining the characteristics of air intakes using the examined methods. They note a strong influence of the Re number on these characteristics.

USSR UDC 533.697

INVESTIGATION OF NONEQUILIBRIUM FLOWS OF AIR IN NOZZLES OF AEROPHYSICAL DEVICES

Novosibirsk VSESOYUZNYY SIMPOZIUM PO METODAM AEROFIZICHESKIKH ISSLEDOVANII [All-Union Symposium on Methods of Aerophysical Investigations, Collection of Works] in Russian, Texts of Reports, 26-29 Apr 76 p 177

KOMAROV, V. N. and POLYANSKIY, O. YU.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B1019 from the texts]

[Text] The authors made a theoretical investigation of high-enthalpy nonequilibrium nonviscous flows of air in nozzles by allowing for the excitation of oscillational degrees of freedom of molecules, chemical reactions and ionization. They determine the regions of equilibrium and freezing of the flows and the gas-thermodynamic characteristics corresponding to them for a broad range of Laval nozzles. The authors propose an engineering method of computing such flows. They give parametric computations of the nonequilibrium flows of air in the nozzles for conditions in the forechamber of 3000°K < T_0 < 8000°K and 1 technical atmosphere < T_0 < 100 technical atmospheres. They give the correlation dependences. The author note the importance of allowing for the nonequilibrium processes in the subsonic part of the nozzle for the gas-dynamic characteristics and structure of the stream at low pressures in the forechamber. They discuss questions of modeling nonequilibrium flows in hypersonic devices.

USSR UDC 531.011

ON RELATIVISTIC MECHANICS WITH A VARIABLE MASS OF REST

Leningrad TRUDY LENINGRADSKOGO INSTITUTA AVIATSIONNOGO PRIBOROSTROYENIYA [Works of the Leningrad Institute of Aviation Instrument Construction] in Russian, No 97, 1976 pp 109-113

FEDYUSHIN, B. K.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9A30 by the author]

[Text] The author obtains the basic equations of relativistic mechanics with a variable mass of rest -- the relativistic equations of Meshcherskiy -- and examines their application to the theory of flight of relativistic jet craft utilizing the surrounding space medium and of relativistic rockets. References 10.

USSR UDC 533.538

COMPUTATION OF THE PROCESS OF STRONG SHOCK WAVE PROPAGATION IN A MAGNETO-GASDYNAMIC RADIAL CHANNEL

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 22-24

KATSNEL'SON, S. S., and SLAVIN, V. S.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9B246 by A. L. Genkin]

[Text] The authors give the results of a quasi-one-dimensional computation of the nonstationary flow of plasma in a radial channel in an axial magnetic field with a value of the magnetic Reynolds number of Re_m approximately equal to 1. The flow is produced by the propagation of a strong shock wave over cold gas. The results of the computation show that the zone of maximum current departs from the front of the shock wave and moves along the channel at the speed of the gas flow, the temperature of the gas in the region of the maximum current is increased and a shock wave reflected from this zone is formed. The features of the flow are explained by the formation of a T-layer. References 7.

USSR UDC 533:538

USE OF THE TOEPLER METHOD FOR THE STRUCTURE OF A SUPERSONIC FLOW OF PLASMA PASSING THROUGH A TRANSVERSE MAGNETIC FIELD

Novosibirsk VSESOYUZNYY SIMPOZIUM PO METODAM AEROFIZICHESKIKH ISSLEDOVANII [All-Union Symposium on Methods of Aerophysical Investigations, Collection of Works] in Russian, Texts of Reports, 26-29 Apr 76 p 187

MIKHAYLOV, A. V., and ZAYTSEV, S. G.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9B251 from the texts]

[Text] For a frame-by-frame registration of the flow of argon plasma (T approximately equal to 1 eV), created by a shock wave, the authors use a pulsed light source on a ruby laser, operating in a mode of resonator quality modulation in combination with an IAB-451 shadow instrument. Use of such a source permitted obtaining a series of instantaneous Toepler diagrams of the process with a frequency of photographing up to 70,000 frames/sec. The authors found that for obtaining a uniform field of the image of the shadow instrument it is necessary to have a one-mode regime of laser generation with a uniform (near the Gaussian) distribution of

radiation intensity in the beam. With the aid of the described source the authors investigated the structure of the flow during the interaction of the supersonic plasma flow with the transverse magnetic field for regimes accompanied by the onset of a shock fracture in the flow (retardation waves).

USSR UDC 533.9

ON THE MODELING OF FIELD CONDITIONS OF FLIGHT IN THE IONOSPHERE

Novosibirsk VSESOYUZNYY SIMPOZIUM PO METODAM AEROFIZICHESKIKH ISSLEDOVANII [All-Union Symposium on Methods of Aerophysical Investigations, Collection of Works] in Russian, Text of Reports, 26-29 Apr 76 pp 55-56

ZHESTKOV, B. YE., and KNIVEL', A. YA.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9B303 from the texts]

[Text] The authors examine several questions associated with taking ionization into account as well as the dissociation and excitation of a gas during an aerodynamic experiment. In connection with the problems of modeling they investigate a high-speed free-molecular current of nitrogen with high retardation temperature in the presence of ion, dissociated and excited components in it. For investigation of the ion and electron components of the stream the authors used a multielectrode probe of special design which permits analyzing the charged components in the presence of a strong stream of neutral gas. With its help they determined the intensity of the ion stream and the distribution function of the ions by velocity. They showed that for the ion component, just as for the neutral one, the flow is equivalent to the flow from a spherical source, the center of the ion stream is approximately equal to the center of the neutral stream and comprises D approximately equal to 10 cm, the velocity ratio is S = 10-12. The degree of ionization of the gas is $\alpha = 10^{-5} - 10^{-4}$ which corresponds to the flight altitudes of 150 - 250 km. The degree of dissociation of the stream was estimated from measurements using thermal flux sensors which possess different degrees of catalyticity. According to these measurements the degree of dissociation is about 1 - 20% which corresponds to altitudes of H = 100 - 200 km.

USSR UDC 532.517.4

INVESTIGATION OF THE PROPAGATION OF ONE- AND TWO-COMPONENT TWISTED STREAMS OF VARIABLE DENSITY

Tallin TURBULENTNYYE DVUKHFAZNYYE TECHENIYA [Turbulent Two-Phase Flows, Collection of Works] in Russian, 1976 pp 69-87

KRASHENINNIKOV, S. YU.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B124 by the author]

[Text] On the basis of data from an experimental investigation the author determines the laws which describe the distribution of averaged parameters of flow in one- and two-component twisted streams propagating in free space and in a cylindrical chamber. In the tests the rate of flow was 5-50 m/sec, the diameter of the channels of the nozzle was 8-18 mm and the diameter of the chamber was 20-70 mm. The author determined the distributions of the time-average velocity and impurity concentration. The relationships of velocities and densities of the mixing gases were varied in the ranges of 0-10 and 0.25-7, respectively. The author obtained data on the structure of the flow, the laws of equalizing the distributions of velocity and concentration upon variation of the intensity of twisting in the range of 0-0.25. He generalizes the results of the measurements on the distributions of concentration in the axial and wall regions of the flow. References 8.

2

USSR UDC 532.526

APPROXIMATE INTEGRATION OF PARAMETRIC EQUATIONS

Kazan' TRUDY KAZAN'SKOGO AVIATSIONNOGO INSTITUTA [Works of Kazan' Aviation Institute] in Russian, No 169, 1975 pp 74-80

POPKOV, A. N.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B133 by the author]

[Text] The familiar method is extended to equations of a plane stationary laminar boundary layer of an ideal gas with arbitrary distributions of surface temperature and velocity of the external flow. The results of the computations from the obtained formulas are compared with the precise solutions by the method of finite differences. The author shows the possibility of using the method for the flow of a gas over a cooled surface and in the region of accelerated flows of liquid and gas. The heat transfer and friction are determined satisfactorily. References 7.

2

USSR UDC 629.78.15:532.526

FLOW NEAR THE STARTING POINT OF INTENSE SUCTION OF A LAMINAR BOUNDARY LAYER IN A SUPERONSIC FLOW

UCH. ZAP. TSENTR. AERO-GIDRODINAM. IN-TA in Russian Vol 7, 1976, No 2, pp 37-44

LIPATOV, I. I.

[From REFERATIVNYY ZHURNAL 41 RAKETOSTROYENIYE No 10, 1976 Abstract No 10.41.109 Resume]

[Text] Flow near the starting point of intense suction of a laminar boundary layer was studied for a plate in a supersonic flow. Equations and boundary conditions describing this flow were derived; an asymptotic solution was found for $Re \to \infty$, $V_w \to 0$. The flow regimes initiated are classified as a function of the ratio of the parameters Re and V_w. The beginning and cessation of intense suction are shown to lead to large unfavorable local pressure gradients, but do not cause boundary layer separation. Figures 5; references 6.

USSR UDC 629.015:533.6.011.5

PRESSURE DISTRIBUTION ON ACUTE CONES AT ANGLES OF ATTACK ALPHA = 0-10° IN A SUPERSONIC FLOW

UCH. ZAP. TSENTR. AERO-GIDRODINAM. IN-TA in Russian Vol 7, 1976 No 2, pp 163-166

LEUTIN, P. G.

[From REFERATIVNYY ZHURNAL 41 RAKETOSTROYENIYE No 10, 1976 Abstract No 10.41.105 Resume]

[Text] Based on experimental studies, an empirical method is described for determining pressure on acute cones with semiangle at apex $theta_s$ = 10-30° for angles of attack alpha $\approx$ 0-10° in the supersonic flow. The method is based on the law of similarity for acute cones with alpha = 0 and on the linear variation of the pressure coefficients with angles of attack in the meridional plane. Figures 3; references 8.

USSR UDC 629.783.015:533.6

DETERMINATION OF AERODYNAMIC CHARACTERISTICS OF ARTIFICIAL EARTH SATELLITES OF COMPLEX SHAPE WITH ALLOWANCE FOR SHIELDING

KOSMICH. ISSLED. NA UKRAINE. RESP. MEZHVED. SB. in Russian No 8, 1976 pp 14-24

GRUDNISTYY, V. V., KAMEKO, V. F., CHEPURNOY, V. N., REZNICHENKO, YU. T., and YASKEVICH, E. P.

[From REFERATIVNYY ZHURNAL 41 RAKETOSTROYENIYE No 10, 1976 Abstract No 10.41.97 Resume]

[Text] Described is a combined experimental-theoretical method of determining the aerodynamic characteristics of artificial earth satellites [AES] of complex shape, with allowance for shielding. The method consists of modeling the incident free-molecular gas flow with a parallel beam of light in which the AES model is fixed, measuring the coordinates of the body contour at the surface of the model and obtaining the total aerodynamic characteristics by integrating over the illuminated surface the components of the aerodynamic force acting on a unit surface area. A device for modeling the flow and measuring the coordinates of points of the body contour at the surface of the AES model is described. Expressions of the aerodynamic forces and moments--convenient for computer programing--acting on the "illuminated" sections of model surfaces are derived: a plate, a right cylinder, a right cone and a sphere. Recommendations are made on using this method in various fields of space technology. Figures 3; references 7.

USSR UDC 629.78.017.2

ASYMPTOTIC METHODS IN ANALYSIS OF ROTATIONAL MOTION OF A BODY HAVING A DAMPER

NEKOTOR. VOPR. DINAMIKI I UPR. DVIZHENIYEM, SB. in Russian Kiev Izd-vo Naukova Dumka 1976 pp 3-10

DRANOVSKIY, V. I., and SALTYKOV, YU. D.

[From REFERATIVNYY ZHURNAL 41 RAKETOSTROYENIYE No 10, 1976 Abstract No 10.41.88 Resume]

[Text] Examined is a particular case of the motion of a body containing a magnet and a magnetic damper along a circular trajectory in a magnetic field formed by a dipole; the intensity vector of this dipole lies in the plane of the trajectory; interaction of the body magnet and the damper is negligibly small. An asymptotic solution is constructed for the rotating body, observed during its slowing down. References 3.

USSR UDC 629.783.015:536.24

THERMAL REGIME OF SUN-ORIENTED INTERKOSMOS SATELLITES

KOSMICH. ISSLED. NA UKRAINE. RESP. MEZHVED. SB. in Russian No 8, 1976 pp 3-14

KOVTUNENKO, V. M., KOPYL, A. I., LATAYKO, P. A., and PETROV, YU. V.

[From REFERATIVNYY ZHURNAL, 41. RAKETOSTROYENIYE No 10, 1976 Abstract No 10.41.79 Resume]

[Text] On the assumption of ideal three-axis orientation toward the sun, analytic functions are derived for calculating the solar radiation reflected from the earth and the intrinsic thermal radiation of the earth at an arbitrary surface element, allowing for nonstationary status caused by kinematic features of artificial satellite motion. Presented are the structure and brief characteristics of the thermal regulation system of the Interkosmos I and Interkosmos 4 satellites, methods of ensuring the thermal regime of instrumentation and some data on temperatures recorded during satellite orbits. Figures 9; references 5.

USSR UDC 629.7.036:621.44

ON A COMPUTATION OF THE MIXING OF A LIQUID SECONDARY JET WITH A SUPERSONIC DRIFTING STREAM

Ufa TRUDY UFIMSKOGO AVIATSIONNOGO INSTITUTA [Works of Ufa Aviation Institute] in Russian No 96, 1975 pp 19-26

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.85 Resume]

SHAKHUTDINOV, Z. G., KLEVANSKIY, V. M., and NAUMOV, YU. N.

[Text] The authors examine a simplified model of a jagged plume of liquid in a supersonic drifting stream, which permits taking into account the nonuniformity of the hydrodynamic characteristics by cross section and to compute the intensity of the phase and chemical transitions in the jet by allowing for the near-real mixing characteristics. Figure 1; reference 1.

USSR UDC (536.24+536.255):532.529

METHOD OF COMPUTING THE SETTLING OF DISPERSE PARTICLES OF A TWO-PHASE FLOW ON THE WALL OF A CHANNEL

Kazan' TRUDY KAZAN'SKOGO AVIATSIONNOGO INSTITUTA [Works of Kazan' Aviation Institute] in Russian No 194, 1975 pp 5-13

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKNETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.127 resume]

IDIATULLIN, N. S., and FILIN, V. A.

[Text] The authors discuss an approximate method of determining the density of inertial flows of particles of the disperse phase, based on computation of the flow field of the carrier gas flow and on subsequent plotting of the trajectory of individual particles in it. Interphase interaction is taken into account in the process of successive approximations. The authors give the results of plotting the flow structure and trajectories of particles of different diameter and density in a channel with axial input and radial output of the two-phase flow.

USSR

ELECTROLYTIC SEPARATION OF EXCESS PHASES OF IRRADIATED FUEL ELEMENT SHEATHS

Dimitrovgrad VOPR. ATOM. NAUKI I TEKHN. SER.: RADIATS. MATERIALOVED., METODIKA I TEKHN. OBLUCHENIYA. in Russian Vyp 6, 1975 pp 22-24

[From REF ZH 50. YADERNYYE REAKTORY No 5, 1976]

BELOKOPYTOV, V. S., NAZARENKO, T. A., and SHCHEGLOVA, V. I.

[Text] Methods have been introduced for electrolytic separation of excess phases from the sheaths of irradiated fuel elements, as well as their preparation for subsequent chemical and X-ray structural analysis. The content of excess phases of fuel element sheaths developed for operation in the BOR-60 nuclear reactors up to 10% burn up is analyzed. 1 illustration; 1 table; 1 reference.

USSR UDC 621.039.51

DEVELOPMENT OF EXPERIMENTAL IRRADIATION DEVICES FOR MATERIALS TESTING IN THE BOR-60 REACTOR

Dimitrovgrad VOPR. ATOM. NAUKI I TEKHN. SER: RADIATSION. MATERIALOVED., METODIKA I TEKHN. OBLUCHENIYA in Russian Vyp 5, 1975 pp 7-13

[From REF ZH 50. YADERNYYE REAKTORY No 5, 1976]

SAMSONOV, B. V., SHULIMOV, V. N., KRUTIKOVA, V. V., SEREDKIN, S. V., and MEL'DER, R. R.

[Text] The start-up of the industrial test BOR-60 fast-neutron reactor made it possible to greatly expand the breadth of research into radiation materials technology. It became possible to resolve such questions as finishing off fuel cells of newly-built fast-neutron reactors; study of radiation swelling of stainless steels, study of corrosive properties of materials in a flow of sodium under the influence of reactor irradiation, and some other questions. In order to perform the entire system of studies, experimental devices are necessary to permit irradiation of materials under different conditions. Methodology questions of design of irradiating devices for fast-neutron reactors are considered. The design of various types of materials technology packs, developed by the BOR-60 reactor, is described. 5 illustrations; 3 references.

USSR

METHODS OF INTRA-REACTOR ANALYSIS OF URANIUM DIOXIDE HEAT CONDUCTION AND CONTACT CONDUCTIVITY AT THE CORE-SHEATH BOUNDARY

Dimitrovgrad. VOPR. ATOM. NAUKI I TEKHN. SER.: RADIATSION. MATERIALOVED., METODIKA I TEKHN. OBLUCHENIYA. in Russian Vyp 5, 1975 pp 14-19

[From REF ZH 50. YADERNYYE REAKTORY No 5, 1976]

TSYKANOV, V. A., SAMSONOV, B. V., SPIRIDONOV, YU. G., and FOMIN, N. A.

[Text] Methods are considered for intrareactor analysis of the coefficient of heat conduction of UO2 as a function of temperature and the magnitude of contact conductivity of the gas clearance between the core and sheath of the fuel element. It is shown that the analysis of these values should be done with different specimens having different fuel column diameters. A method is described for analyzing fuel element output to within 1.5-2.5% accuracy, based on the use of a calibrated electrical heat and special q_c sensor to determine the magnitude of specific energy liberation from reactor gamma-emission in structural element of the channel. It is found that the total error in analyzing the coefficient of heat conduction of UO2 and the magnitude of contact conductivity does not exceed 4.5 and 8%, respectively. 1 illustration; 4 references.

USSR

TEMPERATURE FIELDS IN A NUCLEAR FUEL ELEMENT

Moscow TEPLOOBMEN V ENERG. USTANOVKAKH KOSMICH. APPARATOV in Russian 1975 pp 178-193

[From REF ZH 50. YADERNYYE REAKTORY No 8, 1976]

GALITSEYSKIY, B. M., DANILOV, YU. I., and KOSHKIN, V. K.

[Text] Plate-type, cylindrical and spherical fuel elements are examined. Fuel element and temperature field (TF) plans are presented. TF plans are presented for fuel elements having cylindrical channels placed in 3 and 4-angle lattices. A method is given for designing TF of multiple-layer fuel elements of plate-type construction. Method of design of multiple-layer fuel elements may be successfully used for designing fuel element TF with variable heat liberation according to thickness. This method of design may be expanded to cases where the coefficient of heat conductivity of fuel element material is temperature-dependent. 8 illustrations.

USSR

ON ENERGY CYCLES OF TOKAMAK REACTOR

Leningrad DOKL. VSES. SOVESHCH. PO INZH. PROBL. UPRAVLYAYEM. TERMOYADER. SINTEZA in Russian 1974 Vol 1, 1975 pp 38-47

[From REF ZH 50. YADERNYYE REAKTORY No 8, 1976 8.50.218]

LYSENKO, S. YE., and POPKOV, G. N.

[Text] Ionization and accumulation of impurities in the plasma dislodged from the wall causes cyclic operating conditions of a thermonuclear reactor of the tokamak type. Atomization of the wall by neutrons and alpha particles may affect the course of the fuel cycle, if the coefficient of atomization is greater than the coefficient of atomization affected by D and T. Conditions are calculated under which neutral particles and cool D-T mixture are injected to maintain constant temperature and concentration of working medium, and consequently, nuclear energy output. 5 ill. 6 ref.

USSR

SOME ENGINEERING PROBLEMS IN DESIGNING TOKAMAK-BASED THERMONUCLEAR REACTOR

Leningrad DOKL. VSES. SOVESHCH. PO INZH. PROBL. UPRALYAYEM. TERMOYADER. SINTEZA 1974 in Russian Vol 1, 1975 pp 48-63

[From REF ZH 50. YADERNYYE REAKTORY No 8, 1976 8.50.219]

POPOV, G. N., and SHATALOV, G. YE.

[Text] Plans for an experimental thermonuclear reactors based on tokamak (ETRT). This reactor is designed for experimental proof of the possibility of designing a thermonuclear reactor. Research has been conducted which is needed to develop industrial equipment with high technical and economic characteristics. A reactor block-diagram is presented and the primary systems are described. 37 ill.

USSR

PRIMARY PHYSICAL PROBLEMS AND PARAMETERS OF THE TOKAMAK-10 REACTOR

Leningrad DOKL. VSES. SOVESHCH. PO INZH. PROBL. UPRAVLYAYEM. TERMOYADER. SINTEZA in Russian Vol 1, 1975 pp 109-117

[From REF ZH 50. YADERNYYE REAKTORY No 8, 1976 8.50.220]

ZAVERYAYEV, V. S., POPKOV, G. N., and STRELKOV, V. S.

[Text] The T-10 thermonuclear equipment is designed for solving the following physical problems: production of values of the parameter $n_{\tau E} = 10^{13-8}$ cm, study of plasma in the collisionless region, study and application of additional heating methods (mainly HF-heating). The set of diagnostic equipment used and methods of measurement are described. 3 ill.

USSR

ENGINEERING QUESTIONS IN THE DESIGN OF EXPERIMENTAL TOKAMAK-10 REACTOR

Leningrad DOKL. VSES. SOVESHCH. PO INZH. PROBL. UPRALYAYEM, TERMOYADER. SINTEZA in Russian 1974 Vol 1, 1975 pp 118-126

[From REF ZH 50. YADERNYYE REAKTORY No 8, 1976 80.50.221]

KOMAR, YE. G., MALYSHEV, I. F., MONOSZON, N. A., MURATOV, V. N., ODINTSOV, V. N., ROZHDESTVENSKIY, B. V., SAMSONOV, G. N., and STOLOV, A. M.

[Text] The Tokamak-10 reactor is designed for the study of toroidal quasi-stationary discharge in an intense longitudinal magnetic field. It is assumed that the device will produce plasma with an ion temperature of about 1 keV and density of 10^{14} cm^{-3}. The main parameters of the devices are presented. The structural execution of some systems is described. 2 ill.

USSR

ENGINEERING QUESTIONS OF DESIGN OF EXPERIMENTAL TM-4 REACTOR

Leningrad DOKL. VSES. SOVESHCH. PO INZH. PROBL. UPRAVLYAYEM. TERMOYADER. SINTEZA in Russian 1974 Vol 1, 1975 pp 165-173

[From REF ZH. 50. YADERNYYE REAKTORY No 8, 1976 8.50.222]

BORISOV, VP., VAKHRUSHIN, YU. P., GLUKHIKH, V. A., GRYZLOV, A. I., DOYNIKOV, N. I., IZOTOPOV, YE. N., KLIMOV, A. V., MALYSHEV, I. F., MONOSZON, N. A., ODINTSOV, V. N., POPOV, A. V., ROZHDESTVENSKIY, B. V., SAMSONOV, G. N., SOLOVYOV, YU. V., SPEVAKOVA, F. M., STOLOV, A. M., and FEFELOV, P. A.

[Text] Thermonuclear TM-4 reactor (tokamak-type) is described. It is designed for study of plasma in chamber having wall temperature close to that of reactor wall and for conduct of experiments on HF-heating of plasma. Main parameters of the device are: large torus radius--55 cm, plasma column radius--10 cm, maximum current in plasma--120 kA, plasma confinement time--15 ms, induction of longitudinal magnetic field--4T, pulse repitition rate 1. 2 illustrations.

USSR

PRIMARY PARAMETERS OF THE TOKAMAK-7 REACTOR

Leningrad DOKL. VSES. SOVESHCH. PO INZH. PROBL. UPRAVLYAYEM. TERMOYADER. SINTEZA in Russian 1974 Vol 1, 1975 pp 184-188

[From REF ZH. 50. YADERNYYE REAKTORY No 8, 1976 8.50.225]

IVANOV, D. P., KEYLIN, V. YE., KLIMENKO, YE. YU., and STRELKOV, V. S.

[Text] The Tokamak-7 device is described. It is the first thermonuclear system with superconductive primary magnetic field winding. The maximum field v of the winding surface H_m is about 50 kOe; axially h_z about 30 kOe. With an average winding diameter of about 1 meter, discharge chamber radius a-35 cm, and large torus radius R-122 cm. Energy reserve in magnetic field is 20 MJ with current density in the winding of about 4,000 A/cm^2. 1 illustration.

USSR

MEGAGAUSS THERMONUCLEAR SYSTEM WITH 3D CUMULATIVE LINER

Leningrad VSES. SOVEHSH. PO INZH. PROBL. UPRAVLYAYEM. TERMOYADER. SINTEZA in Russian 1974 Vol 1, 1974 pp 238-260

[From REF ZH 50. YADERNYYE REAKTORY No 8, 1976 8.50.226]

KURTMULLAYEV, R. KH., and MALYUTIN, A. I.

[Text] The proposed system uses the principle of compression of a toroidal plasma configuration by a 3D-cumulative metal liner to produce, at maximum compression phase, dense thermonuclear plasm with high beta. The closed magnetic structure and extremal magnetic fields of the megagauss range permit minimization of scram system dimensions, level of total energy and Lawson confinement time. General evaluation of dimensions and parameters of the system is given. 5 ill.; 10 refs.

USSR UDC 693.547.3

STABILITY AND DEFORMATIVE PROPERTIES OF TYPE 800 CONCRETE TREATED WITH WET HEAT

Moscow (Stroizdat) ZIMNEYE BETONIROVANIYE I TEPLOVAYA OBRABOTKA BETONA [Concreting and Heating of Concrete in Winter, Collection of Articles, edited by S. A. Mironov] in Russian 1975 pp 211-216

AKAMOV, G. A., Candidate in Technical Science, MARKAROV, N. A., and SYSOYEV, YU. N., Engineer

[Abstract] The stability and deformation of high-stability, type 800 concrete treated with wet heat steam were studied. Stability was found to increase during steaming; after 3 hours it reached 75% of the maximum. Without heating the concrete required 7 days to reach 70% of the maximum stability. Increasing sample dimensions did not affect the results. However the modulus of elasticity of normally hardened concrete was 5-6% higher than that of steamed concrete. Tests conducted on reinforced samples indicated that steaming is possible under practical conditions. It is recommended that type 800 concrete be subjected to wet heat like other concretes of lower type. Figures 1; tables 2; references 4: 4 Russian.

USSR UDC 693.547.3

THE EFFECT OF HEAT TREATMENT AND CONDITIONS OF SUBSEQUENT HARDENING ON THE PHYSICAL-MECHANICAL PROPERTIES OF HEAVY CONCRETE

Moscow (Stroizdat) ZIMNEYE BETONIROVANIYE I TEPLOVAYA OBRABOTKA BETONA [Concreting and Heating of Concrete in Winter, Collection of Articles, edited by S. A. Mironov] in Russian 1975 pp 175-189

MALININA, L. A., Dr of Technical Science and RABOTINA, M. V., Engineer

[Abstract] The stability of concrete hardened by steam, autoclave or electrical current was investigated using conditions such that destructive processes were not initiated. It was found that electrical and steam samples had decreased stability to compression and bending. In samples heated one day after preparation the effect increased with decreasing water to cement ratio (w/c), while the reverse was true for samples heated 28 days after preparation. The modulus of elasticity corresponded to stability to compression immediately after preparation and increased after 28 days, but did not always reach the unheated value. Autoclaving increased the stability of concrete to compression, with the effect increasing with a greater w/c. Absolute stability to bending is increased with a

decreasing ratio, while relative stability is decreased due to the influence of the capillary pore structure and increased cohesion between the filler and the dissolved portion. Modulus of elasticity was decreased and independent of the w/c. Autoclaved samples were unchanged after 28 days and had the lowest coefficient of plasticity. This coefficient decreased somewhat with age in all other samples. The lower the w/c, the later the beginning of crack formation. Plastic deformation occurred earlier in electrically heated samples with high w/c and earlier in steamed samples with low w/c. Cracking began sooner in 28 day samples which had been heated electrically. Samples stored in water after heating were more stable to stress and bending. Between 28 days and 3 months the stability of most samples showed an increase, except that of steamed and normally hardened samples stored in dry air. The coefficient of plasticity of the concrete decreased during long-term storage of all samples, indicating that the type of heating had greatest effect in the early stages of hardening. These data indicate that normal stability definitions need to be corrected for type of thermal treatment. Figures 3; tables 3; references 8: 8 Russian.

USSR UDC 624.012.539.4

METHOD OF DETERMINING THE THERMALLY STRESSED STATE OF LARGE CONCRETE BLOCKS DURING THE CONSTRUCTION PERIOD

Leningrad TRUDY LENINGRADSKOGO POLITEKHNICHESKOGO INSTITUTA [Works of the Leningrad Polytechnic Institute] in Russian, No 349, 1976 pp 80-83

MALININ, N. A.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9V972 by I. N. Danilova]

[Text] The author suggested a method of determining the thermally stressed state of concrete blocks at an early age without allowing for creep. The two-dimensional temperature field which is established in the concrete blocks is found by means of solving the Fourier equation of thermal conductivity with internal sources using the method of finite differences. The field of the moduli of instantaneous deformations of concrete is determined by the author by allowing for change in time of temperature at the examined point using an experimentally established dependence of rate of growth of the modulus of instantaneous deformations of the concrete on temperature of hardening of the concrete. The problem of determining the thermally stressed state during the construction period is reduced to finding the temperature stresses in the flat region with time- and coordinate-variable distribution of temperatures and moduli of instantaneous deformations of the concrete. The free problem of thermal elasticity in quasistatic formulation is solved by the method of finite elements. References 5.

USSR UDC 624.012:539.4

RESULTS OF AN EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF VERTICAL LOADING ON RIGIDITY, DAMPING OF VIBRATIONS AND SIZE OF PERMANENT STRAINS OF REINFORCED CONCRETE STRUCTURAL FRAME WITH A RIGID CROSS BAR

Tbilisi SEYSMOSTOYKOST' SOORUZHENII [Seismic Resistance of Buildings, Collection of Works] in Russian, Izd-vo Metsniyereba, No 4, 1975 pp 86-97

CHAKHAVA, G. A.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9V1011 by A. Kh. Koridze]

[Text] The author investigates the rigidity, deformative, and dissipative characteristics of reinforced concrete frame construction, tested for static and dynamic loads by a horizontal force with vertical loading of the structure with a constant load. The static stress of the construction was accomplished with the aid of hydraulic jacks, the dynamic--by a powerful mechanical vibrator of directed action. The experimental investigations demonstrated that the rigidity of the construction is increased by axial loading of the pillars, for cases of static and dynamic stresses it being practically the same size. The author also found that axial loading on the pillars exerts no substantial influence on the size of the logarithmic decrement of the natural vibrations of the construction.

USSR UDC 624.012:539.4

SEVERAL RESULTS OF TESTING STEEL AND IRON REINFORCED CONCRETE GIRDERS

TRUDY ALTAYSKOGO POLITEKHNICHESKOGO INSTITUTA [Works of the Altay Polytechnic Institute] in Russian No 52, 1975 pp 49-55

KAL'NITSKIY, V. V., and IVANOV, V. P.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9V1012 by M. A. Daniyelashvili]

[Text] The authors give the results of a test on strength, deformability and crack resistance of two experimental reinforced concrete girders with a span of 18 m. They measured the vertical and horizontal shifts, the longitudinal strains of the rods and the width of the crack opening. They established that one girder passed the tests for strength but did not pass the tests for rigidity and crack resistance, whereas the second girder did not pass the tests only for crack resistance. The authors recommend a number of measures to eliminate these deficiencies.

USSR UDC 624.012:539.4

EXPERIMENTAL INVESTIGATION OF THE WORKING OF ROOFINGS OF CROSSED BEAMS

Leningrad ISSLEDOVANIYE, RASCHET I ISPYTANIYE PROSTRANSTVENNYKH METALLICHESKIKH KONSTRUKTSIY [Investigation, Design and Testing of Three-Dimensional Metal Constructions, Collection of Works] in Russian, 1975 pp 38-40

ZAMALIYEV, F. S. and KHISANOV, R. I.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9V1013 by L. V. Sasonko]

[Text] The authors demonstrate that roofings of crossed rod systems are finding increasing application in construction, whereas the working of roofings of rods and beams crossed in three directions has been still insufficiently studied. They examine the working of such roofing with triangular and hexagonal meshes in the plan. The problem of the investigations was the experimental proof of the theoretical positions of designing the examined roofings; here for the girders they used the hypothesis of flat cross sections, and their working is examined as the working of ordinary beams. They show that use of metal for making small-scale models leads to great problems, in connection with which for preparation of the models polystyrene is often used. The investigations showed that polystyrene under short-term loading functions elastically, and wire detectors reinforce this low-modular material. An experimental roofing with dimensions of 74.6 and 60.2 cm was loaded with a nodal load. Computation of the roofing was done by computer using the method of finite differences and allowed making a conclusion about the good convergence of the computational sagging and moments with the experimental results. Models of polystyrene operated in the elastic stage.

USSR UDC 624:539.4

STUDY OF DYNAMIC EFFECT OF IRREGULAR WAVES ON INDIVIDUAL FLEXIBLE CYLINDRICAL SUPPORTS

SB. TR. MOSK. INZH.-STROIT. IN-T in Russian No 101, 1976 pp 15-24

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B970 by L. M. Kurshin]

LUZHIN, O. V., KASPARSON, A. A., and MIRZOYEV, D. A.

[Text] A study is made of the dynamic action of waves on a marine mobile drilling installation, a floating platform with equipment on long flexible supports. Experiments involving measurement of the parameters of waves and bending moments in the cross sections of the supports was performed on two flexible models of supporting rods and one rigid model. The work was performed in a wave trough 30 m in length, 1.2 m wide and 1.4 m deep. The lengths of the cantilevers was 1 m, diameter 3.6 cm. The measurement data are used to construct distribution functions of the ordinates of wave oscillations and bending moments. These functions are shown to agree with the normal distribution. It is also shown that for flexible supporting rods, the spectra of bending moments are significantly narrower than the spectra of wave oscillations and their maximum corresponds to the natural oscillating frequency. It is concluded that the form of the spectrum of wave oscillations is significant for dynamic design of supports.

USSR UDC 624.012.4.69.022.042.045:681.3

DETERMINING EQUISTABLE CROSS SECTIONS OF THE CONCRETE WALLS OF MONOLITHIC STRUCTURES

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 5, 1976 pp 66-69

VAL', YE. G., Engineer, Central Scientific-Research Institute of Standard and Experimental Planning of Housing, Moscow

[Abstract] A method is proposed for determining the optimum cross section of monolithic concrete walls with respect to material expenditure and in order that all walls of the building be in approximately the same stress condition under vertical and horizontal loading. The problem is solved with a simplex method on the basis of discrete-continuum design of the building. An example computation is given for a five-wall portion of an 8-story building under a 9-ball seismic load. For the five walls making up the portion of the structure the discrepancy between the bearing capacity of the wall cross section and actual loads on it is within 10% for M-200 concrete. Ill 1; tab 2; biblio 3.

USSR UDC 531/539

DESCRIPTION OF HIGH FREQUENCY VIBRATION OF COMPLEX DYNAMIC SYSTEMS BY METHODS OF THE THEORY OF HEAT CONDUCTIVITY

Moscow IZBRANNYYE PROBLEMY PRIKLADNOY MEKHANIKI [Selected Problems of Applied Mechanics -- Collection of Works] in Russian 1974 pp 535-542

PAL'MOV, V.A., Leningrad Polytechnical Institute

[Abstract] The purpose of this study is to analyze high frequency vibration caused by the influence of external and lateral loads. A discussion is presented of the possibility of using simplified equations similar to the heat conductivity equation to describe and analyze three-dimensional high frequency oscillations. The necessity and expediency of studies in this direction is related to the significant complexity of the study of three-dimensional oscillations by existing methods. 5 references.

USSR UDC 536.24:536.42;669-154

INFLUENCE OF POROUS NONMETALLIC COATINGS ON HEAT EXCHANGE DURING BOILING OF AMMONIA ON BEAMS OF PIPES

Leningrad KHOLODIL'NYYE MASHINY I USTROYSTVA [Refrigeration Machines and Devices, Collection of Works] in Russian 1976 pp 52-56

DYUNDIN, V. A., KUPRIYANOVA, A. V. and KOZYREV, A. A.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9B471 by S. G. Povsten']

[Text] The authors made an experimental investigation on intensifying heat exchange during the boiling of ammonia on a beam of pipes, jacketed with glass fiber. The beam consisted of 19 steel pipes with a diameter of 25 x 3 mm with a relative step of $s/d_H = 1.36$. The active length of the heaters $l_{act} = 280$ mm. The variation range in density of the thermal flux in the tests was 500-12,000 W/m^2 and temperature of boiling from -20 to +20°. The authors investigated three types of experimental beams: beam No 1 - surface of pipes coated with cinder; beam No 2 - surface of pipes of beam No 1 treated with polishing paper No 3; beam No 3 - pipes of beam No 2 jacketed with glass fiber, 0.3 mm thick. They showed that the intensity of heat yield grows from series to series and the sixth series has the highest values of α. For beam No 3 the authors note an intensification

of the process of ammonia boiling upon jacketing of the pipes of the beam with glass fiber. For all pipes in this case in the investigated variation range of q the coefficient of heat yield is increased with rise in temperature t_0. In the range of q = 1000-4000 W/m^2 the mean coefficients of heat yield of the jacketed beam exceed α_{av} of beam No 2 by 3.5-1.3 times and slightly exceed α_{av} obtained during investigation of beam No 3 on F-22. The high intensity of heat exchange on the pipes of the beam coated with glass fiber is explained by the feature of the mechanism of boiling on such surfaces. References 7.

USSR UDC 536.24:536.42;669-154

INVESTIGATION OF THE BOILING OF FREON 113 IN A VERTICAL SLOTTED CHANNEL

Leningrad KHOLODIL'NNYYE MASHINY I USTROYSTVA [Refrigeration Machines and Devices, Collection of Works] in Russian 1976 pp 48-52

AZARSKOV, V. M., ZEMSKOV, B. B., and MALYSHEV, A. A.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9B472 by S. G. Povsten']

[Text] The authors made an experimental investigation of the process of heat yield during the boiling of freon 113 and a mixture of it with oil in a flat vertical slotted channel. The channel consists of two flat walls: one is made of a glass textolite plate on which a copper heatable foil, 0.05 mm thick, is cemented; the other is made of plastic. The conditions for conducting the experiment are the following: atmospheric pressure, density of thermal flux q = 1000-20,000 W/m^2, static level h = 100-300 mm, height of channel H = 300 mm, width of channel δ = 0.5-0.4 mm, concentration of oil in the freon ξ = 3, 4 and 6%. The authors found that upon boiling inside the slotted channels and on the vertical wall for copper and steel surfaces of varying roughness, with increase in q the mean coefficient of heat yield is increased, the degree of influence of q being reduced with decrease in δ and h. They note an increase in heat yield for channels δ < 2 mm. The heat yield is substantially increased when h is decreased, especially in the case of q < 10,000 W/m^2. They detected an influence of roughness of the heat-yielding surface on the heat yield in the case of boiling on a vertical wall. The coefficient of heat yield during boiling on a rougher copper plate is 20% higher than for a steel polished plate. During boiling in the slotted channels with δ < 2 mm the values of the coefficient of heat yield for both surfaces were practically identical. It is shown that the concentration of KhF-22 oil up to 3% with freon 113 boiling in a slotted channel δ = 1.0 mm exerts practically no influence on heat yield. Further increase in oil concentration leads to a decrease in the coefficient of heat yield.

USSR UDC 536.46:533.6+534.222.2

EXPERIMENTAL INVESTIGATION OF A DOUBLE SYSTEM OF JETS IN A TRANSVERSE FLOW DURING COMBUSTION

Kazan' EKSPERIMENTAL'NOYE ISSLEDOVANIYE PARNOY SISTEMY STRUY V POPERECHNOM POTOKE PRI GORENII [Experimental Investigation of a Double System of Jets in a Transverse Flow During Construction] in Russian, Kazan' Aviation Institute, 1975, 9 p, Manuscript deposited in the All-Union Institute of Scientific and Technical Information 3 Jun 76, No 1988-76 Dep

KOSTERIN, V. A., MASHCHENKO, G. I., and SHALAYEV, G. M.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9B589 DEP by the authors]

[Text] The authors present the results of an experimental investigation of the expansion of a double system of round jets in a transverse flow upon combustion of a kerosene-air mixture in the zone of their interaction. They examine the influence of the combustion process on the dimensions of the gas screen, created by the systems of the jets and the dimensions of the zones of reverse currents formed behind the systems of jets in comparison with the "cold" conditions. They give the empirical equations for the trajectories of the systems of jets and the ratios of the dimensions of the zone of reverse flows and the gas screen for different relative steps of the system of jets, the hydrodynamic parameter and the composition of the mixture of the transverse stream.

USSR UDC 532.529

METHOD OF COMPUTING INERTIAL DEPOSITION OF DISPERSE PARTICLES OF A TWO-PHASE STREAM ON THE WALL OF A CHANNEL

Kazan' TRUDY KAZAN'SKOGO AVIATSIONNOGO INSTITUTA [Works of Kazan' Aviation Institute] in Russian, No 194, 1975 pp 5-13

IDIATULLIN, N. S. and FILIN, V. A.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B622 by the authors]

[Text] The authors discuss an approximate method of determining the density of inertial streams of particles of the disperse phase based on computation of the field of flow of the carrier gas stream and on subsequent construction of the trajectories of individual particles in it. The interphase interaction is taken into account in the process of successive approximations. They present the results of computing the structure of the flow and the trajectories of the particles of different diameter and density in the channel with an axial input and radial output of the two-phase stream.

EAST GERMANY

REALIZATION OF THE HEATING CONCEPT FOR THE CITY OF KARL-MARX-STADT

Leipzig ENERGIEANWENDUNG in German Vol 25 No 5, May 76 pp 145-150 manuscript received 15 Jan 76

SCHURICHT, Winfried, and TAUSCHER, Ralf, graduate engineers, Power Supply State Enterprise, Karl-Marx-Stadt

[Abstract] Public and private spaces will be heated by a remote heating system with three thermal power plants, using hot water at a temperature of 150-160°C and small amounts of steam in the vicinity of the northern plant. Industries are served with low-pressure steam where needed. The northern thermal power plant has two steam-generator units, and is fired with coal. It provides 75 MW or 220 Gcal/hr, and has a radially designed distribution system with a transmission capacity of 500 Gcal/hr. It is now under expansion. The Altchemnitz plant is now being built; it will have two 100 Gcal/hr generators supplied by Romania. There is also a plant in Beimler Street, and there are two heat reservoirs. Some difficulties are created by the fact that the residential and industrial construction trends are unclear so that the expansion of the transmission network cannot be scheduled according to a precise plan. Figures 7; no references.

1/1

USSR UDC 533.6.011.8

THE PARADOX OF INFINITE PROPAGATION VELOCITY OF PERTURBATIONS IN THE HYDRODYNAMICS OF A VISCOUS, HEAT CONDUCTING MEDIUM AND EQUATIONS OF HYDRODYNAMICS OF RAPID PROCESSES

AEROMEKHANIKA in Russian, Moscow, Nauka Press, 1976 pp 289-299

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B267 by the author]

KHON'KIN, A. D.

[Text] A discussion is presented of the paradox of infinite propagation velocity of perturbations in the hydrodynamics of a viscous heat conducting medium, as described by the Navier-Stokes and Fourier transfer laws. The Bolzman equation is used to produce equations for the hydrodynamics of rapid processes, which are correct for times of the same order of magnitude as the time of free path movement. These are hyperbolic equations with a finite propagation velocity of perturbations. They are used to discuss the problem of unstable propagation of heat, which is now described by a hyperbolic equation with finite propagation velocity, equal to the speed of sound. Conditions are studied under which the difference of the equations produced from the classic equations is significant. Equations of the hydrodynamics of fast processes are discussed for dense media and multicomponent systems. 15 references.

USSR UDC 536.248.2.001.5

INVESTIGATION OF HEAT EXCHANGE IN THE SUPERCRISIS REGION OF SMOOTH AND ROUGH STEAM GENERATING CHANNELS

Minsk TEPLOMASSOOBMEN - V. MATERIALY V VSESOYUZNOY KONFERENTSII PO TEPLOMASSOOBMENU [Heat and Mass Exchange - V. Materials From the Fifth All-Union Conference on Heat and Mass Exchange, Collection of Works] in Russian Vol 3, Part 2, 1976 pp 41-48

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 10, 1976 Abstract No 10G86 by O. V. Remizov]

STYRIKOVICH, M. A., LEONT'YEV, A. I., POLONSKIY, V. S., and MALASHKIN, I. I.

[Text] The authors propose an analytical model of heat exchange in the supercrisis region, based on analogy with the process of heat exchange in dissociating or chemically reacting gases in the boundary layer and

using the asymptotic theory of a turbulent boundary layer. Processing of the test data of the authors and a series of tests of other investigators in accordance with the proposed model revealed a satisfactory convergence of the experimental and computational results. The method is recommended for use in the following range of regime parameters: pressure (98-167) bar, mass velocity (500-1400) kg/(m^2·sec), specific thermal flux greater than 214 kW/m^2, mass flow-rate steam content greater than 0.38. The authors demonstrated the high effectiveness of artificial roughness in the intensification of heat exchange in a disperse regime of flow of a two-phase flux. Figures 6; references 8. [High-Temperature Institute, Academy of Sciences USSR, Moscow].

USSR UDC 621.18.002.637

CONDITIONS OF LOCAL HEATING OF THE METAL OF LOW RADIATION SECTION PIPES DURING THE GROWTH OF INTERNAL SEDIMENTS

TRUDY ALTAYSKOGO POLITEKHNICHESKOGO INSTITUTA [Works of the Altay Polytechnic Institute] in Russian No 48, 1975 pp 89-94

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 10, 1976 Abstract No 10R134 by B. N. Khodyrev]

MAGIDEY, P. L., and FILONOV, A. F.

[Text] Under the conditions of long-term exploitation with the aid of temperature fuses, an investigation was made of the temperature regime of the operation of baffle pipes at the Litovsk, Lukomol'sk, Kostromsk and the Sredneural'sk State Regional Electric Power Plants in the furnaces of PK-41 and TGMP-114 steam generators. Graphs are given for the change in perceived thermal fluxes and temperatures of the pipe walls in the furnaces and the dependence of the amount of sediments in the pipes of the baffles of the TGMP-114 steam generator on the length of operation on black oil with a content of Fe oxides in the feed water of 15-20 mkg/kg. It was established that the computed values of the heat resistance of the layer of internal sediments grow with duration of continuous exploitation of the steam generator from $(0.1\text{-}0.16)\cdot10^{-3}$ at first to $(0.25\text{-}0.3)\cdot10^{-3}$ m^2·hour·°C/kcal through 6000 hours of operation with an Fe content in the feed water of 15-20 mkg/kg. Figures 2; table 1; references 6.

USSR UDC 536.248.2.001.24

INTENSITY OF HEAT EXCHANGE AND CRISIS OF HEAT YIELD DURING BOILING UNDER CONDITIONS OF FREE MOTION

Minsk TEPLOMASSOOBMEN - V. MATERIALY V VSESOYUZNOY KONFERENTSII PO TEPLOMASSOOBMENU [Heat and Mass Exchange - V. Materials From the Fifth All-Union Conference on Heat and Mass Exchange, Collection of Works] in Russian Vol 3, Part 1, 1976 pp 321-330

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 10, 1976 Abstract No 10G81]

TOLUBINSKIY, V. I.

[Text] The results of generalizing test data on the intensity of heat exchange during boiling of a liquid in great volume with the aid of the equation of similarity $Nu = 75\ K^{0.7} \times Pr^{-0.2}$. Efficiency of this equation is proven. Analysis is given of the generalized dependence derived by the author for computing the first critical flux $q_{cr\ 1}$. The author gives the results of the generalization with the aid of this dependence for the test data on $q_{cr\ 1}$ in a broad range of pressures for 15 different liquids. The maximum scatter in data comprises $\pm$35%, the average scatter is $\pm$25%. Figure 1; references 10.

USSR UDC 536.248.2.001.24

GENERALIZATION OF THE CHARACTERISTICS OF BOILING BY THE METHOD OF THERMODYNAMIC SIMILARITY

Minsk TEPLOMASSOOBMEN - V. MATERIALY V VSESOYUZNOY KONFERENTSII PO TEPLOMASSOOBMENU [Heat and Mass Exchange - V. Materials From the Fifth All-Union Conference on Heat and Mass Exchange, Collection of Works] in Russian Vol 3, Part 1, 1976 pp 14-21

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 10, 1976 Abstract No 10G79 by D. B. Yankovskiy]

GOTOVSKIY, M. A., BORISHANSKAYA, A. V., and DANILOVA, G. P.

[Text] The authors give a generalization of test data on the boiling of liquids in order to define more precisely the bonds of several characteristics of boiling with basic thermodynamic parameters (T_{cr}, P_{cr}, the gas constant R, molecular weight M). Comparison of the data on detached diameters during boiling of water, freon and ammonia led to the

dependence $D_r = 5 \cdot 10^5 (kT_{cr}/P_{cr}M)^{1/3} (P/P_{cr})-0.46$, k is the Boltzmann constant. Comparison of the data on the coefficient of heat emission for a broad range of materials, including organic liquids and liquefied gases, using computations from a previously suggested formula (V. M. Borishanskiy and V. A. Shleyfer in the Collection "Heat and Mass Transport During Phase Transitions" Part 1, Minsk, Institute of Heat and Mass Exchange, Academy of Sciences Byelorussian SSR, 1974 p 202) revealed the necessity of allowing for the dependence of the coefficient of heat emission on relative temperature T_s/T_{cr} in the form of the factor:

$$\varphi (T_s/T_{cr}) = 1.1(T_s/T_{cr})^4 (P/P_{cr})^{-3/8}.$$

Figures 2; references 21.

USSR UDC 621.455 + 662.215.1 + 534.012

THEORY OF OSCILLATIONS EXCITED BY THE BURING INSTABILITY IN ROCKET ENGINES

Kiev DOPOVIKI AKADEMII NAUK UKRAINS'KOI RSR, SERIYA FIZIKOMATEMATICHNI TA TEKHNICHNI NAUKI in Ukrainian No 10, 1976 pp 892-895 manuscript received 19 Jan 76

ASLANOV, S. K., Odessa University

[Abstract] The problem of the instability of the turbulent combustion process in a chematized one-dimensional combustion chamber of a rocket engine is stated and solved analytically. Only two ranges of unstable oscillations, low-frequency and high-frequency, proved to be possible. Quantitative characteristics of the latter and the excitation criteria are in good agreement with the experimental data. Biblio 6.

USSR UDC 662.75

EXPERIMENTAL INVESTIGATION OF THE CHARACTERISTICS OF THE FUEL PETROLEUM PLUS A MIXTURE

Kazan' TRUDY KAZAN'SKOGO AVIATSIONNOGO INSTITUTA [Works of Kazan' Aviation Institute] in Russian No 186, 1975 pp 16-19

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 8, 1976 Abstract No 8.49.138 resume]

YERMOLAYEV, M. D., and MAGSUMOV, T. M.

[Text] The authors derive experimental values of one of the energy characteristics of the fuel, petroleum plus a mixture, of the consumption complex beta as a function of the ratio of components $\chi = G_0/G_2$. They examine the method of igniting this mixture from an extraneous heat source, and they also determine the boundaries of the stable operation of the combustion chamber as a function χ. Figures 2; references 3.

USSR UDC 533.538

THERMAL BEHAVIOR OF A LOCALLY COMPRESSED GAS IN AN ARC IN A CHANNEL

TEPLOMASSOOBMEN -- V. MATERIALY V VSES. KONF. PO TEPLOMASSOOBMENU Vol 8, in Russian, Minsk 1976 pp 234-242

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B310 by V. V. Blagov]

KREMER, K. J., and KHSIA, KH. S.

[Text] A study is made of certain hydrodynamic and heat exchange phenomena in an arc discharge with local compression of the gas stream where there are no chemical reactions. The experiments were performed in a plasmotron with a cooled circular anode, a rod cathode, cylindrical channel of electrically insulated and cooled sections (diameter 9 mm) and a sector with radial gas injection. The radial injection nozzle is formed by two neighboring sections, there is a fully developed arc discharge before the injection slit. The distance between the cathode and the anode and the width of the injection slit are variable. The working gas is argon. The distribution of electric potential, heat flux to the wall and static pressure on the wall are measured. The characteristic value of current is 100-200 a, flow rate of main gain 0.17 g/sec, flow rate of injection gas 0.25 g/sec, pressure 20-60 mmHg, heat flux 1-1.5 kw/cm, gas flow velocity 20-120 m/sec.

Measurements in the arc yield a negative value of electric field before the injection slot and beyond it, at other locations of the arc column it is positive. Spectroscopic measurements allow production of temperature profiles. Injection is not found to have any great influence.

USSR UDC 536.24:532.54

FORMULAS FOR DETERMINATION OF TURBULENT VISCOSITY AND HEAT TRANSFER DURING FLOW IN PIPES

RASCHET I MODELIR. TEPLOVYKH PROTSESSOV in Russian No 2, Kuybyshev 1976 pp 47-51

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B468 by the author]

MAYATSKIY, G. A.

[Text] A new formula is presented for determination of the turbulent viscosity in the entire wall area of a boundary layer, which is then applied for determination of heat transfer upon turbulent motion in pipes using a known plan. The values of Nu calculated by digital computer for $Re=1\cdot10^4-1\cdot10^6$, Pr-1-100, $Pr_t=1-0.8$ agree with the solutions of other authors and experimental data, in which the influence of variable physical properties on heat exchange is ignored. 9 references.

USSR UDC 536.24:536.42;669-154

EXPERIMENTAL STUDY OF THE CRITICAL HEAT FLUX DENSITY DURING BOILING OF HELIUM IN A LARGE VOLUME

VOPR. TEPLOFIZ. YADER. REAKTOROV in Russian No 5, Moscow, Atomizdat Press 1976 pp 97-100

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B489 by A. A. IVASHKEVICH[

ANDREYEV, V. K., GORDEYEV, YU. V., DEYEV, V. I., BOZHANOV, A. YU., PETROVICHEV, V. I., and SMIRNOVA, N. V.

[Text] The boiling of liquid helium was performed on a horizontal copper surface 25 mm in diameter. Heating was by a direct electric current

passing through a heater of manganin wire. The temperature of the working section was measured by a thermocouple and resistance thermometer. The temperature of helium in the volume was measured by a resistance thermometer. The first critical heat flux density was determined by a sharp increase in temperature of the heat liberating surface after a slight increase in heater power. The experiment showed that the first critical heat flux density increases with an increase in pressure, reaching a maximum ($\sim 1.15 \cdot 10^4$ w/m^2) at a pressure $p \approx 0.7 \cdot 10^5$ n/m^2, then decreases, approaching zero in the area of the critical point. The experimental data agree with the results of other investigations with an accuracy of 30%. 8 references.

USSR UDC 532.516

MOTION OF A SPHERICAL SMOOTH PARTICLE IN A NONUNIFORM FLOW OF VISCOUS INCOMPRESSIBLE LIQUID

Voronezh ISSLEDOVANIYA PO MEKHANIKE SPLOSHNYKH SRED [Investigations on the Mechanics of Solid Media, Collection of Works] in Russian, No 2, 1974 pp 46-51

KUPTSOV, V. S.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B46 by G. Z. Gershuni]

[Text] In Stokes approximation the author solves the problem of streamlining of a solid spherical particle by a nonuniform flow of viscous incompressible liquid. The yields of velocity and pressure are obtained with an accuracy up to terms on the order of $(a/L)^3$, where a is the radius of the sphere and L is the scale of nonuniformity of the flow. He finds the force which acts on the particle and writes an equation of motion of the particle. An analogous examination was made for a liquid drop with a nondeformable spherical surface. The viscosity of the drop differs from the viscosity of the external flow.

USSR UDC 532.517.4

MATHEMATICAL MODELING OF A FREE SHIFT-FREE TURBULENCE IN A STRATIFIED MEDIUM

Novosibirsk VSESOYUZNYY SIMPOZIUM PO METODAM AEROFIZICHESKIKH ISSLEDOVANII [All-Union Symposium on Methods of Aerophysical Investigations] in Russian, 26-29 Apr 76, Texts of Reports, p 167

VASIL'YEV, O. F., KUZNETSOV, B. G., LYTLIN, YU. M. and CHERNYKH, G. G.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B114 by T. D. Krashennikova]

[Text] The authors examine the plane nonstationary problem of development of the region of turbulent mixing in an incompressible density-stratified liquid. To describe the flow they developed a semiempirical model in which along with the averaged equations of motion, incompressibility and continuity they give equations for normal Reynolds stresses. Here in the initial moment of time in a certain region, the dimensions of which are assumed to be finite, they give the turbulent perturbations and deviation of the density of the medium, caused by movement of the liquid in this region.

USSR UDC 536.24:532.54

HEAT AND MASS TRANSPORT IN A CYLINDRICAL PIPE UNDER CONDITIONS OF COMBINED TWISTING OF ONE- AND TWO-PHASE GAS-LIQUID FLOW

Minsk TEPLOMASSOOBMEN - V [Heat and Mass Exchange - V, Collection of Works] in Russian, Vol 4, 1976 pp 113-117

OSIPENKO, YU. I.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B465 by A. S. Mazo]

[Text] The author shows experimentally that the use of an additional "snake" vortexer for the purpose of reducing twisting in a cylindrical pipe (damping under the influence of viscosity) permits significant intensification of the heat and mass exchange and increase in the energy effectiveness of the apparatus. Thus, in a pipe with a diameter of 40 mm and a length of 600 mm the arrangement of the secondary vortexer with a length of 80 mm and an angle of input of 58° (ensuring shock-free inleakage) and angle of output of 82° (figured from the axis of the pipe) at a distance of 200 mm from the pipe input with an initial degree of twisting of 1.8 (ratio of the total area of the cross section of all tangential slots to the area of the cross section of the pipe) with Re = 10^4-10^5 intensifies the heat transfer from the wall to the stream by 1.5 times. Analogous results are obtained for the mass yield during evaporation of a film of water which covers the surface of the pipe with moderate specific consumptions of liquid corresponding to a non-stall flow of the film.

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USSR UDC 533.697

VELOCITY PROFILES AND HYDRAULIC RESISTANCE OF A STREAM OF AIR IN A PLANE-PARALLEL CHANNEL WITH REGULAR WALL ROUGHNESS

Obninsk PROFILI SKOROSTI I GIDRAVLICHESKOYE SOPROTIVLENIYE POTOKA VOZDUKHA V PLOSKOPARALLEL'NOM KANALE S REGULYARNOY SHEROKHOVATOST'YU STENOK [Velocity Profiles and Hydraulic Resistance of a Stream of Air in a Plane-Parallel Channel With Regular Wall Roughness] in Russian, Physics and Energy Institute, Preprint FEI-672, 1976, 29 p

SUBBOTIN, V. I., USHAKOV, P. A., BOLTOYEV, YU. D., GABRIANOVICH, B. N. and LEVCHENKO, YU. D.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B1032]

[Text] The authors present the results of an experimental study of fields of velocity and hydraulic resistance of a turbulent

isothermal stream of air in a rectilinear channel of rectangular cross section (ratio of sides 6:1) with regular roughness. For Reynolds numbers from 10,000 to 450,000 the authors obtain data for seven different distances between elements of roughness which had in cross section a rectilinear shape and relative height of 0.095 of the half-width of the channel. Annotation.

7

USSR UDC 533.6.07

INVESTIGATION OF THE PHYSICO-CHEMICAL STRUCTURE OF THE FLOW OF AIR IN AEROPHYSICAL DEVICES WITH HIGH SLOW-DOWN PARAMETERS

Novosibirsk VSESOYUZNYY SIMPOZIUM PO METODAM AEROFIZICHESKIKH ISSLEDOVANII [All-Union Symposium on Methods of Aerophysical Investigations, Collection of Works] in Russian, Texts of Reports, 26-29 Apr 76 p 39

KOMAROV, V. N., POLYANSKIY, O. YU. and SNIGEREV, YU. I.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B1102 from the texts]

[Text] The authors suggest a method of computing the concentrations of nitric oxide forming in the channels of aerophysical devices. They take into account the nonequilibrium character of the physico-chemical processes during the flow of air in a nozzle, diffusor and refrigerator. They investigate the role of these elements in the process of freezing the nitric oxide. On the basis of the suggested method they make parametric computations on a computer for the various devices and different values of temperature and pressure of slow-down in the ranges of $1 < P_0 < 300$ technical atmospheres, $2000 < T_0 < 7000°K$.

USSR UDC 620.197.6:627.842

USE OF ANTICAVITATION PROTECTION IN DIVERSION TUNNEL NO 2 AT THE NUREK HYDROELECTRIC POWER STATION

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 10, 1976 pp 12-15

ILYUSHIN, V. F., GURTOVNIK, F. I., and YAZEV, R. YE.

[Abstract] No 2 (of three) diversionary tunnel at Nurek has operated for four years at flow speeds of up to 35-42 m/sec and water discharges of up to 2,000 m^3/sec. The steel shell in the discharge section protects against cavitation and is corrosion resistant. The zone endangered by cavitation is 70-100 meters long and 7-10 meters diameter and must be finished with concrete of high cavitation-resistance plus a protective coating of epoxy compounds and waterglass, since observations have revealed local areas of pitting and exfoliation. Ill 4; Tab 2; Biblio 1.

USSR UDC 627.84:532.59

LOWERING THE PRESSURE PULSATIONS IN PUMPED STORAGE PLANT PENSTOCKS BY ADMISSION OF AIR UNDER THE RUNNER

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 8, 1976 pp 12-14

ZOLOTOV, L. A., KLABUKOV, V. M., and VLADIMIRSKIY, V. M.

[Abstract] General results are given of research on the pressure pulsations in various cross sections along the length of the penstock at the Kiev pumped storage plant. Admission of air into the runner area was shown to be an effective means of damping the pressure pulsations along the entire length of the penstock when reversible hydromachines are operated in the turbine mode. Admission of 750 liters/sec of atmospheric air (at p = 1 kg/cm^2, t° = 20°C, static head 70.8 m) reduced the relative pressure fluctuations to 59%. Under similar conditions the admission of compressed air reduced the relative pressure pulsations to 45.5%. The greater reduction with compressed air is explained by the fact that the flow rate remains constant during the closing of the guide vanes, whereas with atmospheric air the flow rate gradually diminishes. Ill 4; Tab 1; Biblio 6.

USSR UDC 620.193.16:622.224.001.572

DETERMINATION OF THE CAVITATION FACTOR OF HYDRAULIC TURBINES BY THE ENERGY METHOD

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 8, 1976 pp 17-20

EDEL', YU. U.

[Abstract] Author analyzes various methods of determining turbine cavitation factors in relation to operational efficiency. It is shown that the most competent method is to find that cavitation factor value that corresponds to the moment of initiation of cavitation effect on the energy parameters of the total installation. Equality of cavitation factors at the moment the energy parameters of the installation are affected (C_{ust}) does not necessarily denote similarity of cavitation flows in similar turbines during isogonal operational modes. The similarity is destroyed more and more with advanced cavitation, thus the lower the C_{ust} value becomes by comparison with the C_{turb} value (cavitation factor at cavitation initiation in the turbine). Selection of a critical cavitation factor C_{cr} in the area of C_{ust} at which the influence of cavitation on the energy parameters is determined by any method leads to considerable diversity in the values of C_{turb} for similar turbines operating in isogonal modes. The indeterminateness in the selection of the critical cavitation factor, although not removed entirely, can be mitigated if we take the C_{ust} value to be the critical value. Ill 7; Biblio 5.

USSR UDC 620.192.16:621.224

REDUCING CAVITATION EROSION IN HYDRAULIC TURBINES

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 8, 1976 pp 14-16

PYLAYEV, N. I.

[Abstract] Tests conducted at the Tsimlyan hydroelectric power plant for cavitation erosion of turbine rotor blades after 30,000 hours of operation showed extensive erosion to depths of 30-35 mm in carbon steel 30L. In the same steel with a jacket of 1Kh18N9% stainless there were localized areas of erosion where the jacket had been penetrated and the 30L substrate eroded to depths of up to 15 mm. The blades made of 25Kh14NL stainless had practically no cavitation erosion. Tests at two other stations produced comparable results. Methods of reducing cavitation erosion are discussed from the points of view of fabrication of parts that are exposed to cavitation of cavitation-resistant stainless steels, and turbine design involving the reduction of the intensity of cavitation effects. Ill 3; Biblio 4.

USSR UDC 626.13

GROUND PRESSURE AGAINST BULKHEADS WITH LATERAL WING WALLS

Moscow GIDROTEKHNIKA I MELIORATSIYA in Russian No 9, 1976 pp 29-32

SOKOLOV, A. D.

[Abstract] The hydraulic-engineering problem of active ground pressure against bulkheads with lateral wings is solved for the case where the wings are situated orthogonally with respect to the frontal portion of the bulkhead, and the surface of the burden is horizontal. On the basis of the theory of limited equilibrium of collapse (slip) prisms of soil, with friction forces along the base taken into account, an expression is obtained for ground pressure and the pressure-reduction factor. Vertical and inclined friction forces are treated separately. The influence of friction forces along the surfaces of the wing walls increases the active ground pressure significantly and depends on the ratio 1/h of the wall. With greater wall length the specific weight of the friction forces is reduced, and the problem approaches the two-dimensional. For 1/h greater than 2 the difference in the pressures for the two-dimensional and three-dimensional problems does no exceed 5-6%. Ill 5; Table 2; Biblio 4.

HUNGARY

INVESTIGATION OF TRANSIENT PHENOMENA IN FLUID PIPELINES WITH THE AID OF THE MATRIX OPERATOR

Budapest ENERGIA ES ATOMTECHNIKA in Hungarian Vol 19 No 8, Aug 76 pp 344-352

DANKO, Gyorgy, graduate mechanical engineer, graduate applied mathematician, Department of Mechanical Engineering, Budapest Technical University

[Abstract] With the aid of a computer, the author prepared a dimensionless matrix set which contains all transient information for any fluid pipeline system (at a limited degree of accuracy, within a time period determined by the required accuracy). A matrix equation was derived for the relationships between the momentary pressure and velocity values at the two ends of a pipe section, which permits the expression of any of these parameters when unknown, using the matrix of the pipe-section operators as the coefficients. The article derives the differential equation system, linearizes it, and describes its solution. It presents the approximating matrix-operator determination of the initial and generalized limit value relationships, and illustrates the quasi-linear application of the matrix operators. Figures 5; tables 2; references 21: 13 Hungarian and 8 Western.
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USSR UDC 532.516

ON SEVERAL FEATURES OF THE MOTION OF MATERIALS BETWEEN TWO ROTATING CYLINDERS WHICH OBEY NEWTON'S LAW

Leningrad TRUDY LENINGRADSKOGO INSTITUTA AVIATSIONNOGO PRIBOROSTROYENIYA [Works of the Leningrad Institute of Aviation Instrument Construction] in Russian No 97, 1976 pp 81-85

GERMAN, L. N., KULISTOVA, N. P., PANAYOTOVA, L. A., and ROZE, N. V.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9B62 by the authors]

[Text] The authors examine the problem of the movement of Newtonian liquids between two rotating cylinders. They make computations of the pressures, the tangential stresses and other parameters necessary for planning automatic control systems of technological processes of treating metals and several polymer materials. References 7.

USSR UDC 531.011

NEW PROOF OF THE THEOREM OF ADDING VELOCITIES AND THE THEOREM OF ADDING ACCELERATIONS OF A POINT

Novosibirsk VOPROSY DINAMIKI MEKHANICHESKIKH SISTEM VIBROUDARNOGO DEYSTVIYA [Questions in the Dynamics of Vibroimpact-Acting Mechanical Systems, Collection of Works] in Russian 1976 pp 136-143

BYCHKOV, A. I.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9A34 by the author]

[Text] The article contains: a list of the basic concepts of the theory of component motion of a point and a critique of several terms used in the textbooks on the theory of mechanics. The author introduces a new concept in the theory--the concept of a surface for the transport motion of a point. He gives proof of two addition theorems using the natural procedure for assigning the motion of the points.

USSR UDC 621.181

A METHOD OF DETERMINATION OF THE MINIMUM PERMISSIBLE FLOWS IN П AND U-SHAPED ELEMENTS BASED ON STABILITY CONSIDERATIONS AT SUPERCRITICAL PRESSURE

Moscow TEPLOENERGETIKA in Russian No. 7, Jul 76 pp 33-37

SHVARTS, A.L., GLUSKER, B.N., All-Union Institute of Heat Engineering-State Trust for Organization and Rationalization of Regional Electric Power Plants and Networks

[Abstract] A method is presented for construction of hydraulic characteristics in dimensionless parameters, allowing determination of the extremal points of characteristics and pressure drops in loops with rising and falling motion of the medium without construction of hydraulic diagrams; the extremal flow rates in elements consisting of parallel coils providing reliable hydraulic modes in them can be determined without complex preliminary calculations, and the area of unambiguity of hydraulic characteristics can be located. For loops in which parallel connected pipes have different and multivalued hydraulic characteristics, loss of stability will occur in the pipe, the minimum hydraulic characteristic of which is equal to or greater than the pressure drop in the loop. Stability for all pipes is assured when the loop operates with a mean flow rate providing a pressure drop higher than the maximum pressure drop at the point of the minimum of the characteristic for all of the pipes. This condition is the basis for provision of stability, related to the multiple values of hydraulic characteristics in the actual elements of steam generators. References 5: all Russian.

USSR UDC 621.165.533.6

ANALYTIC METHOD FOR OPTIMIZATION OF THE PARAMETERS OF THE LAST STAGE WITH MINIMUM POWER LOSSES WITH THE OUTPUT VELOCITY

Moscow TEPLOENERGETIKA in Russian No. 7, Jul 76 pp 61-65

SHUBENKO-SHUBIN, L.A., POZNAKHIREV, V.F., ANTIPTSEV, Yu.P., TARELIN, A.A., Institute of Machine-building Problems, Acad. Sci. UkSSR

[Abstract] An analytic study is presented of the mathematical model of the thermal gas dynamic problem of the last stage in a high power steam turbine. The model of the process consists of three equations of motion in projections on the r, z and u axes and the equations of continuity, state and the first law of thermodynamics. The optimization problem is solved by means of the apparatus of the calculus of variations. A study is made of the three-dimensional flow at the output of the drive wheel. The solution of the problem shows that in order to achieve the minimum energy loss with output velocity of the stage, it is necessary that the radial and circular components of the absolute velocity of the output from the drive wheel be equal to zero, while the axial component is constant throughout the radius of the stage. References 2: both Russian.

EAST GERMANY

INFORMATION TRANSFER BY LINEAR TRANSMISSION SYSTEMS

East Berlin MESSEN-STEUERN-REGELN MIT AUTOMATISIERUNGSPRAXIS in German Vol 19 No 2, Feb 76 pp 55-58

KYNAST, H., graduate engineer, Process Engineering Section; Area: Automation Engineering, Carl Schorlemmer Technical University, Leuna-Merseburg

[Abstract] Linear transmission systems with stochastic input signals are investigated, using some basic principles from the field of information theory such as entropy, conditional entropy, and transinformation. The goal of the project — quantitative characterization of information processes taking place in automation systems so as to obtain new, objective insight into the behavior of automated processes and to permit them to be made more rational — is first approached by studying simple examples illustrating simple principles. The article discusses the determination of the entropy relations and the mean square transmission error, and the relationships between information transmission and mean square transmission error. Table 1; references 8: 1 Russian and 7 German.

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USSR UDC 621.73.043:669-419.4

DETERMINING THE OPTIMUM MODES FOR MILLING HIGH-TEMPERATURE CAST ALLOYS

Moscow STANKI I INSTRUMENT in Russian No 5, 1976 pp 28-29

MAKAROV, A. D., and SHAROV, G. A.

[Abstract] Results are given of a study of the main optimum milling characteristics for face finishing cast nickel-base alloys ZhS3, ANV-300, ZhS6, ZhS6U, and VZhL-12, with Al + Ti contents from 4.1% to 10.6%; tensile strengths 90-114 kg/mm^2 at 20°C, with a VK8 carbide milling tool. It was found that the main indices of machinability (optimum milling rate and milling temperature and relative surface depletion) depend on the content of the hardening gamma' phase in these alloys and the true tensile strength at elevated temperature. The hardening gamma' phase in the studied alloys ranges from 18% (ZhS3) to 58% (VZhL-12). Formulas are given for computing the main indices of machinability, and a nomogram is devised for determining the optimum milling modes for both conventional and more recently developed high-temperature cast alloys. Ill 4; Tab 1; Biblio 5.

USSR UDC 621.73.043:669-419.4

HOT FORGING OF BIMETALLIC SHAPED WORK

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 10, 1976 pp 81-82

KOLOS, V. I., and PASTUSHKOV, A. V.

[Abstract] A description is given of a process of forging a gear of a bimetal of steel 18KhGT and Steel 20. The gear was forged under a 2-ton pressure after heating in a gas furnace. The billet was made up of two outer (35-mm) parts of Steel 20 and one inner (60-mm) part of 18KhGT welded together. Metallographic studies of the finished forging showed a boundary zone with sharpness independent of degree of deformation and no defects along the jointing lines of the two metals. Along the jointing line on the Steel-20 side was a thin continuous layer of ferrite varying in thickness from 0.03 to 0.06 mm. Data from hardness tests indicated that no transition zone existed along the jointing line. Tensile tests in all cases showed no ruptures along the jointing line, rather within the area of Steel-20 which has a lower strength limit than the 18KhGT steel. Results of the study indicated the technological feasibility of the forging process used. Ill 3; Biblio 3.

USSR UDC 666.965.2.002.237

ON THE TECHNOLOGICAL RE-EQUIPPING OF SILICATE BRICKYARDS IN SEISMIC REGIONS

Moscow STROITEL'NYYE MATERIALY in Russian No 10, 1976 pp 18-19

BOLKVADZE, L. S.

[Abstract] Silicate brick, a chief building material in which the USSR is the world's largest producer, is economically advantageous to produce, but has certain shortcomings as a building material for areas with high seismic activity, including poor adhesion to mortar. Its bonding strength to ordinary mortar is much lower than that of clay brick and seldom exceeds 0.6-1.0 kg/cm^2; in the majority of cases it deteriorates with time and may drop to zero within a year. Many recent laboratory and field tests have shown silicate brickwork to have a rating of only category 3, which means that it cannot be used for buildings more than three stories high. Experiments conducted with the silicates of various deposits indicate that the conversion of silicate brickyards in seismic regions should involve changing their production from silicate bricks to large silicate-concrete structural parts. Ill 2; Biblio 1.

USSR UDC 007.52

DESIGN PRINCIPLES OF MOTOR-DRIVEN AUTOMATIC MANIPULATOR SYSTEMS WITH PROGRAMMED CONTROL (INDUSTRIAL ROBOTS)

Moscow STANKI I INSTRUMENT in Russian No 4, 1976 pp 3-10

KOBRINSKIY, A. YE., KORENDYASEV, A. I., SALAMANDRA, B. L., and TYVES, L. I.

[Abstract] On the basis of an analysis of actual material from Soviet and foreign sources the authors discuss the development trends in motorized industrial robots and compare alternative methods of orienting the drive motors. A description is given of a method of static design of grippling mechanisms that affords the possibility of making a valid selection of an operational system that takes configurations, dimensions, relative positions of parts, centers of gravity, functions, and strengths into consideration. Mechanism variations are described that will guarantee kinematic uncoupling of robot circuits. The concept of passive control is discussed. These systems enhance the dynamic characteristics of a robot and guarantee the tautness of its kinematic linkages. Ill 10; Tab 1; Biblio 11.

USSR UDC 621.594.002

INVESTIGATION OF THE PROCESS OF FREEZING CARBON DIOXIDE OUT OF FLUE GAS

Moscow KHOLODIL'NAYA TEKHNIKA in Russian No 10, 1976 pp 22-27

TITOV, V. B., All-Union Scientific-Research Institute of the Refrigeration Industry

[Abstract] Author describes experimental installation and method for investigating the process of freezing carbon dioxide out of flue gases. The installation is a closed gas cycle with a dry-ice separator consisting of a solid copper, liquid-hydrogen-cooled plate in a textolite duct, a condenser and regenerator. The CO_2 is frozen out on the surface of the plate and sublimated. Information and formulas are given on the density and heat conductivity of the layer of frozen CO_2. The data presented can be used as a basis for industrial production of dry ice from stack gases. Ill 6; Biblio 7.

USSR UDC 621.789-977

ON THE POSSIBILITY OF USING HIGH-SPEED DEFORMATION FOR THE THERMOMECHANICAL STRENGTHENING OF STEELS

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 9, 1976 pp 5-7

SMIRNOV, M. A., GANAGO, O. A., VAYSMAN, I. M., KENDYSH, V. P., and DAMMER, A. E.

[Abstract] Specimens of Kh18N10T and EI69 steels, after preheating to 1,100°C and 1,180°C and holding for 30 min and 1 hr 30 min, respectively, were subjected to high-speed forging at 20 m/sec, which produced 30% deformation. In the case of Kh18N10T steel the creep limit and tensile strength increased by 7 kg/mm^2 (11%) and 36.5 kg/mm^2 (165%), respectively, in comparison with 4 kg/mm^2 (6%) and 18 kg/mm^2 (80%) after deformation by hydraulic press at 0.02 m/sec. The greatest increase in strength properties occurred when the deformation rate was increased from 0.02 to 4 m/sec, after which the increase was more gradual. EI69 steel showed similar increases in strength limits. Results indicate that high-speed forging can be used to strengthen austenitic steels during high-temperature thermomechanical treatment, while preserving high ductility. However, the behavior of the thereby altered substructure under various loading conditions must still be investigated. Ill 5; Biblio 3.

USSR UDC 629.7.036.002.2

PROCEDURE AND SETUP FOR RENOVATING WORN-OUT PARTS OF AVIATION GAS-TURBINE ENGINES

Kiev VOPROSY POVYSHENIYA NADEZHNOSTI, DOLGOVECHNOSTI I VOSSTANOVLENIYA AVIATSIONNOY TEKHNIKI [Increasing the Reliability, Lifetime and Renovation of Aviation Technology, Collection of Works] in Russian No 1, 1975 pp 38-41

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.105 by K. Ye. V.]

KOVAL'CHUK, YU. M., and KARASEV, A. V.

[Text] It is shown that for the renovation of edges of a bound turbine rotor blade, one can use argon-arc welding of a wear-resistant superalloy such as stellite in the form of wire. However, such a method of renovation has low technico-economic indicators because of the nonproductive consumption of material and low mechanization. The developed procedure utilizes a plasma method of depositing the coating, a finely disperse KKHN-15 powder with particle dimensions of 20-40 micrometers being used as the weld materials. Comparative analysis of the argon-arc welding of high-quality alloys and microplasma welding of the KKHN alloy that were used demonstrated the technological advantages of the latter, specifically lower cost, higher coefficient of material utilization, and decrease in time for subsequent mechanical treatment. References 2.

USSR UDC 536.2.02:681.332

DETERMINATION OF BOUNDARY CONDITIONS OF HEAT EXCHANGE IN PARTS OF STEAM TURBINES BY THE METHOD OF SOLVING THE INVERSE PROBLEM OF HEAT CONDUCTIVITY

ENERGITICHESKOYE MASHINOSTROYENIYE. RESPUBLIKANSKIY MEZHVEDOMSTVENNIY TEMATICHESKIY NAUCHNO-TEKHNICHESKIY SBORNIK [Power Machine Construction. Republic Interdepartmental Thematic Scientific-Technical Collection] in Russian No 21, 1976 pp 36-41

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 8, 1976 Abstract No 8.49.49]

MATSEVITYY, YU. M., MALYARENKO, V. A., and SHIROKOV, V. S.

[Text] The authors discuss a procedure for determining the nonstationary boundary conditions of heat exchange on surface elements of structures of turbomachinery by solving the inverse problem of heat conductivity on

unit models. They give a description of an analog device and the results of determining boundary conditions of the I and III sort on it for a flange element of the outer case of a high-pressure cylinder of the K-300-24 Khar'kov Turbogenerator Plant steam turbine in the startup regime with sliding steam parameters. Figures 2; table 1; references 6.

USSR UDC 539.374;539.214

STUDY OF KINEMATIC CHARACTERISTICS OF THE FOCUS OF PLASTIC DEFORMATION DURING ROLLING

USTOYCHIVOST' I PROCHNOST' ELEMENTOV KONSTRUKTSIY in Russian No 2, Dnepropetrovsk 1975 pp 140-148

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12V391 by the authors]

VLASENKO, YU. YE., FEN', G. A., SHLOMCHAK, G. G., and KUZ'MENKO, V. I.

[Text] A finite-difference method developed by the authors is used for the first time to calculate theoretically the kinematic characteristics of a focus of plastic deformation for various cases of rolling of high strips in the interval $\ell/h_{av}=0.3-0.7$. The calculations are performed for cases of planar deformation. Boundaries and shape of plastic and rigid areas are determined. The distribution of flow velocities of the tensor components of deformation rate and deformation rate intensity is produced.

The information produced is analyzed in comparison with experimental data available in the literature. The results of the solution agree with existing concepts concerning the regularities of the kinematic characteristics of metal in the focus of deformation during rolling of high strips.

USSR UDC 629:12:532

ON THE DYNAMICS OF A PONTOON FASTENED BY ANCHORS

Leningrad XXIX GERTSENOVSKOGO CHTENIYA. MATEMATIKA [Twenty-Ninth Hertz Lecture. Mathematics, Collection of Works] in Russian, 1976 pp 50-51

LIVSHITS, L. S.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B986 by N. A. Kolesnikova]

[Text] The author investigates the dynamics of a pontoon in the form of a rectangular parallelipiped fastened by eight anchors and its equation of motion with theaid of mechanisms arranged on it. In formulation of the problem control of the pontoon is reduced to changing the length of the anchor chains. The author takes into account the effect on the pontoons of the perturbing forces caused by swelling of the sea, damping wave and viscosity forces and hydrostatic forces. The swelling of the sea is considered to be small and regular, i.e., the perturbing forces are harmonic. The control effects are introduced in the form of supplemental forces which are computed in linear approximation and added to the perturbing forces. The recovery moments are computed by metacentric formulas. Thus the author obtains a linearized system of equations of motion of the pontoon. As a result of the investigation of the obtained system the author makes the conclusion that transverse rolling of a pontoon will be connected with drift, and longitudinal rolling -- with the course of the pontoon. Vertical rolling and yawing of the pontoon are found to be independent.

USSR UDC 533.6.013.42

ANALYSIS OF THE HYDRODYNAMIC LOAD CAUSING ELASTIC VIBRATIONS OF DEEPLY IMMERSED IMPELLERS

Leningrad TRUDY LENINGRADSKOGO KORABLESTROITEL'NOGO INSTITUTA [Works of the Leningrad Shipbuilding Institute] in Russian, No 100, 1975 pp 33-41

KARTUZOV, YE. I. and ROSTOVTSEV, D. M.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9V294 by the authors]

[Text] The authors examine the question of determining the hydrodynamic loads acting on a vibrating deeply immersed movable

impeller. The computations on determining the hydrodynamic pressure on an impeller of infinitely large expanse were made on the basis of nonstationary impeller theory. In analyzing the results the authors explained that for regimes of high-frequency impeller vibration, corresponding to Strouhal numbers 7-15, one can ignore certain of the pressure components. This fact made it possible to find approximating expressions for the hydrodynamic pressure acting on the impeller. Use of the obtained approximating expressions allows a significant reduction in the time consumed for practical computations on determining hydrodynamic loads.

USSR UDC 629.12:539.4

INVESTIGATION OF THE DYNAMIC CHARACTERISTICS OF A SHIP'S HULL UNDER FREE VERTICAL BENDING VIBRATIONS

Leningrad TRUDY LENINGRADSKOGO KORABLESTROITEL'NOGO INSTITUTA [Works of Leningrad Shipbuilding Institute] in Russian, No 100, 1975 pp 81-90

SIVERS, M. N.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9V827 by the author]

[Text] The author examines free vertical bending vibrations of thin-wall box-like rods of multiconnected cross section. The frequencies and reduction coefficients for such a rod are determined on the basis of solving a dynamic two-dimensional problem of the theory of elasticity for plates contained in it, with further examination of the conditions of connection at the butts of intersecting plates. The author gives justification of the possibility of using rod theories for determining the dynamic characteristics of bending vibration of thin-wall structures, in particular of ships' hulls. The author computes the reduction coefficients of the area of the cross section based on additional allowance for the shift deformations in the bands. As an example the author compares the frequencies computed by various methods for a rod with four horizontal bands.

USSR UDC 629.12:532

ON THE PROBLEM OF EQUILIBRIUM OF A FLOATING BODY

Moscow NAUCHNYYE TRUDY. INSTITUT MEKHANIKI MOSKOVSKOGO UNIVERSITETA [Scientific Works. Institute of Mechanics of Moscow University] in Russian, No 40, 1975 pp 126-131

SAMSONOV, V. A.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B980 by A. K. Nikitin]

[Text] The author shows that the problem of equilibrium of a floating body may be formulated as a problem of the extremum of potential energy and stable positions of equilibrium correspond to the minima of the potential energy. The author discusses three cases: (1) the algorithm for seeking positions of equilibrium, (2) stability of equilibrium of floating bodies and (3) complication of the problem. In the first case he examines a fixed vessel with an ideal uniform liquid, into which the body B is placed. The system body -- liquid possesses ideal bonds, one of which has the form

$$\int_{(\tau)} d\tau = \tau_0 = \text{const}$$

where (τ) is the region occupied by the liquid at a certain moment of time and τ_0 is the volume of this region. For external potential forces the potential energy of the system is

$$V = \int_{(\tau)} \rho u_1 d\tau + u_0$$

where u_1 is the potentials of the mass forces applied to the particles of liquid; u_0 is the potential energy of the body. Seeking the extremum V is suggested to be done in two stages. At the first stage the body is fixed in a certain position and $V'(q_i)$ is determined, i.e., the family of extrema of the potential energy according to the forms of the liquid, in particular, $V_0(q_i)$ -- the minimum V. At the second stage the author seeks the extremal points of the functions $V(q_i)$ and $V_0(q_i)$. He examines an example when the body B of rectangular shape "floats" in a two-dimensional heavy liquid. He presents the curves of equilibrium with indication of the stable and unstable branches. In the second case he discusses the question of stability of equilibrium of floating bodies. He shows the difficulty of the problem for the presence of a "defect" in the medium (i.e., removal of part of the liquid from the vessel) when tossing of the body is developed. Then he discusses the complication of the problem: (a) when the vessel A is filled with several non-mixable liquids of equal density; (b) a floating body has a cavity partially filled with one or several incompressible ideal liquids; (c) when the liquids possess surface tension. In cases (b) and (c) expressions are written for the potential energy. References 6.

USSR UDC 629.12:532.5.075.001.5.002.54

A METHOD OF STOPPING A SHIP

OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 42, 1976 pp 39 Item No 535188

LUSNIKOV, V. F., and LUSNIKOV, V. F.

[Text] A method of stopping a ship including the operation of reversing of the engine and feeding air to the screws is distinguished by the fact that to increase the effectiveness of stopping of the ship by eliminating the turbine mode of the screws during reversing of the engine, which is rigidly coupled to the screws, air is fed into the area of the screws simultaneously with reversing of the engine, then airfeed is halted when the engine reaches the normal operating speed.

USSR UDC 539.385

BEARING CAPACITY OF A NEW FRAME STEEL

Moscow VOPROSY PROCHNOSTI KRUPNYKH DETALEY MASHIN [Questions of the Strength of Large Machine Parts, Collection of Works] in Russian, Izd-vo Mashinostroyeniye, 1976 pp 14-18

CHUDNOVSKIY, A. D. and RAFALOVICH, I. M.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9V1157 by the authors]

[Text] The results are given from investigations of the low-cycle fatigue of frame steels 14GNMA and 16GNM on samples of of large cross sections with concentrators which permitted modeling the conditions of local strength of materials in the construction. It was shown that the processes of accumulation of damages and fracture for these materials are similar. The weak manifestation of the scale factor was noted in the interval of cross sections of 40-100 mm. This indicates the possibility of using samples of small cross section (40 x 40 mm) for evaluating the cyclical strength of thick-sheet materials. The feasibility is confirmed of overall comparative analysis of the properties of materials by modeling different strength, and also by analysis of "zones of fracture", sensitivity to local overload and other indicators. It is shown that the investigated materials possess similar characteristics of low-cycle bearing capacity. References 5.

USSR UDC 539.4

INFLUENCE OF STRESSES IN THE ELASTIC REGION ON THE DECAY OF MARTENSITE DURING ANNEALING

Moscow PROBLEMY METALLOVEDENIYE I FIZICHESKAYA METALLURGIYA [Problems of Metal Research and Physical Metallurgy, Collection of Works] in Russian, Izd-vo Metallurgiya, No 3, 1976 pp 170-175

ALEKSEYEVA, L. YE.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9V1079 by the author]

[Text] A radiographic investigation is made of the decay of martensite under conditions of the effect of an external tensile stress in the elastic region (pure bending) during deep annealing of high-carbon steels 60Kh12, 70Kh13, and 100N14. It is shown that stress in the elastic region produces an acceleration in decay of martensite at the first stage of annealing. References 12.

USSR UDC 53.94

USE OF ULTRASOUND FOR STUDYING THE INFLUENCE OF STRUCTURE ON THE MODULUS OF ELASTICITY OF AN Al-Mg ALLOY

Moscow PROBLEMY METALLOVEDENIYE I FIZICHESKAYA METALLURGIYA [Problems of Metal Research and Physical Metallurgy, Collection of Works] in Russian, Izd-vo Metallurgiya, No 3, 1976 pp 192-199

IZOTOV, V. I., VOZNESENSKIY, V. V. and BASHCHENKO, A. P.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9V1080 by the authors]

[Text] Using the methods of luminous and electronic microscopy for illumination an investigation was made on the change in martensite structure of 45KHNMFA steel during measurement of the size of the original martensite grain. It was shown that the structure of the martensite crystals remain constant. The size of the martensite crystals varies in proportion to the size of the austenite grain, if the size of this latter grain does not exceed 20 micrometers. The dependence was found for the yield stress of structural steels on the size of the austenite grain. References 11.

USSR UDC 539.385

INVESTIGATION OF THE LAWS OF DEVELOPMENT OF FATIGUE CRACKS IN A TWO-STAGE REGIME OF LOADING

Kiev PROCHNOST', NADEZHNOST' I DOLGOVECHNOST' AVIATSIONNYKH KONSTRUKTSIY [Strength, Reliability and Lifetime of Aviation Constructions, Collection of Works] in Russian No 1, 1975 pp 48-54

KUCHMARENKO, A. P.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9V1187 by L. M. Shkol'nik]

[Text] The author gives the dependences which permit computing by use of an analytical method the lifetime of the parts under gradual change in the loading regime. He shows the possibility of using the Paris formula for investigation of the kinetics of development of a fatigue crack on the transitional segment. The experiments were made on flat samples of D16AT, 2 mm thick, with a concentrator in the form of an opening, 1.5 mm in diameter. The frequency of loading is 400 cycles/minute. Measurement of the lengths of the cracks was done by an optical method.

USSR UDC 539.385

RESISTANCE OF LOW-CYCLE FATIGUE OF STRUCTURAL STEELS ACTED ON BY LOW TEMPERATURES

Moscow VOPROSY PROCHNOSTI KRUPNYKH DETALEY MASHIN [Questions of the Strength of Large Machine Parts, Collection of Works] in Russian, Izd-vo Mashinostroyeniye, 1976 pp 10-13

CHUDNOVSKIY, A. D., RAFALOVICH, I. M., VINKLER, O. N., and LARIONOV, V. V.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9V1156 by the authors]

[Text] Data are given on the low-cycle low-temperature strength of 09G2S and St 3 steels. It is shown that at a temperature of -40° the resistivity of multiple static fracture is decreased. The general laws are given for low-cycle low-temperature fracture. The lifetime is determined by two mutually related processes -- temperature and mechanical. Under the conditions of low-temperature multicycle loading the resistance of the materials to the onset of fatigue damage grows. At the same time these damages embrittle the material. The predominant role of any of the processes also determines the reliability of the constructions. Under low-cycle loading embrittlement of the material may be accompanied by a reduction in resistivity to development of damage, which makes such a regime more hazardous. References 10.

USSR UDC 621.825.54.002.3:669.018.42

USE OF HIGH-TEMPERATURE 40Kh3M2FA STEEL FOR HEAVILY LOADED CLUTCH PLATES

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 6, 1976 pp 45-46

YEVDOKIMOVA, V. M., MELIKYAN, G. A., and CHIZHIKOV, G. I.

[Abstract] Since the steels 30KhGSA, 65G and 85, in which the creep limit drops to 5 kg/mm^2 at 700 deg C, have failed as materials for the clutch plates of the Kirovets tractor, which develops localized temperatures of 600-750 deg C in its clutch plates in towing modes, the high-temperature steel 40Kh3M2FA is recommended as a substitute. This steel has a creep limit of 90 kg/mm^2 at 700 deg C, which is 10-15 times that of the earlier used steels. Ill 2; Biblio 2.

USSR UDC 669-418.5:669.15-194:539.4

INFLUENCE OF THE STRUCTURAL STATE OF KH15N9YU STEEL STRIP ON ITS STRENGTH AND FATIGUE PROPERTIES

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 6, 1976 pp 75-76

PCHELINTSEV, V. A., MARCHENKO, V. G., and SOSNOVSKIY, L. A.

[Abstract] An explanation is given of the change of cyclic strength in relation to phase state in the steel strip used in compressor valve springs. The difference in the strength and fatigue properties of specimens of the same thickness is due primarily to the presence of a varying amount of the austenitic phase in the surface layer, since the central layers have identical phase compositions. Strip containing about 70% untransfored austenite in the surface layer has the highest fatigue strength. In cyclic loading modes the beta-to-alpha transformation in Kh15N9Yu steel is more intensive during impact loading and less intensive under bending loads. The considerable difference in the strength characteristics of the Kh15N9Yu steel is due to a large extent to nonuniformity of the technological processes of fabrication. Ill 2; Tab 2; Biblio 3.

USSR UDC 621.73:669.15'24'26'28-194.001.2

INVESTIGATION OF THE NATURE OF HAIRLINE CRACKS IN FORGINGS OF Cr-Ni-Mo STEEL

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 9, 1976 pp 3-4

RYBAKOVA, YU. A., BALYURA, L. S., KLESHCHEV, A. A., and GORIN, V. A.

[Abstract] Hairline cracks in forgings of Cr-Ni-Mo steel and the related silvery spots in the fracture surface are caused by the segregation of manganese sulfides in the form of extra-axial liquation threads which form during the forging of the initial billet. This could explain why in forgings of one configuration cracks appear in the same areas even for different melts. Apparently the cracks are formed at those sites in the billet to which the involved extra-axial liquations migrate during the deformation of part of the bar; thus the deformation pattern likewise plays a significant role. The silvery spots that develop as defects in the fracture surface of Cr-Ni-Mo steel may develop in zones of extensive accumulation of nonmetallic impurities which cannot be removed by preventing annealing. The defect can be removed only by increasing the trimming of the bar from the shrinkage head or by remelting the steel. Ill 4; Biblio 5.

USSR UDC 539.4.015;669.017

ON THE RELATIONSHIP OF THE STRENGTH AND STRUCTURAL CHARACTERISTICS OF STAINLESS MARTENSITE-AGING STEELS

Kiev PROBLEMY PROCHNOSTI in Russian No 10, 1976 pp 21-25 manuscript received 22 Jun 75

NIZHNIK, S. B., OSTROVSKAYA, V. P., USIKOVA, G. I., and CHERNYAK, N. I.

[Abstract] A study is made of the influence of the chemical composition, conditions of hardening, and plastic deformation of stainless martensite-aging steels (EP-288, EP-410, VNS-17, and EP-699Sh) on the structural change of the martensite and on the dimensions and distribution pattern of the particles of the intermetallic phase. Those structural characteristics are defined which have a linear relationship with the creep limit of these steels under various hardening conditions. Analytical expressions are obtained for the stress-strain diagrams (in the elastic-plastic and and plastic regions) of normalized and age-hardened steels, with the characteristic structural changes of the martensite during plastic deformation and hot-hardening taken into account. A formula is given that can be used to estimate the nature of strain hardening (beyond the creep limit) of age-hardened stainless martensite-aging steels on the basis of their structure in the undeformed state. Ill 6; Tab 4; Biblio 9.

USSR UDC 669.017:539.4.015

STRUCTURAL PECULIARITIES DURING STRAIN HARDENING OF TRANSITION CLASS STEEL

Kiev PROBLEMY PROCHNOSTI in Russian No 10, 1976 pp 36-41 manuscript received 22 Jun 75

GORB, M. L., NIZHNIK, S. B., OSTROVSKAYA, V. P., and CHERNYAK, N. I.

[Abstract] For the transition-class steel, chromium-nickel stainless Kh16N6, the possibilities were investigated of finding an analytical expression for the connection between stress and strain in the temperature interval of stable austenite, metastable austenite, and quenched martensite (800-20°C), with the structural and phase transformations during the testing taken into account. For the temperature interval of stable austenite or martensite the strain curve for compression and tension in the plastic region may be approximated by the function $\sigma(\varepsilon)=K_{\varepsilon n}$, the parameters of which vary with the degree of austenite depletion by the alloying elements in the process of carbide formation, and with the quantitative ratio of quenched martensite and strain-hardened martensite. For the Kh16N6

steel with martensite structure an analytical expression is obtained for the stress-strain relationship, with the characteristic narrowing of the x-ray interferences of the alpha phase taken into account. It is found that the creep limit of the steel is not a linear function of the amount of residual austenite. Ill 6; Tab 4; Biblio 8.

USSR UDC 621.59.002.3:669.15

STEELS AND ALLOYS FOR CRYOGENIC MACHINE BUILDING

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 7, 1976 pp 52-56

LEBEDEV, D. V.

[Abstract] Author discusses several steels and alloys which are used in temperatures of 25 to -260°C. Widely used chromium-nickel stainless with 18-20% Cr and 8-12% Ni, often stabilized with niobium or tantalum, has good mechanical properties down to -269°C but tends toward martensite transformation, which makes it unfavorable for use as a structural material, particularly in experimental physics. For such purposes a chromium-nickel stainless with 18-25% Cr and 14-25% Ni is preferred. Studies conducted at the Central Scientific-Research Institute of Ferrous Metallurgy showed a promising future for the use of Kh12N20TZR, Kh21N5AGT, KhN35VTYu, KhN77TYu, and KhN40MDTYu in cryogenic machine building. The properties and specific uses of these and several other alloys are discussed. Tab 6; Biblio 3.

USSR UDC 539.5

AGE-HARDENING OF DEFORMED KH18N10T STEEL UNDER THE ACTION OF A SMOOTHLY INCREASING LOAD

Kiev PROBLEMY PROCHNOSTI in Russian No 10, 1976 pp 75-78 manuscript received 16 Jun 75

GINDIN, I. A., NEKLYUDOV, I. M., NETESOV, V. M., OKOVIT, V. S., and STAROLAT, M. P.

[Abstract] Results are given of a study of the influence of plastic deformation and subsequent age-hardening under loading and without loading on the formation of the dislocation structure, change in strength characteristics, and amplitude dependence of internal friction in austenitic steel Kh18N10T. It was established that age-hardening

under a slowly increasing load at 600°C causes an orientational distribution of dislocations and attaches them more intensively to the particles of the new phase. Apparently such a structure causes the presence of the maximum on the curve for creep-limit increase vs predeformation and was responsible for the increase in the critical fracture amplitude observed during measurements of the dependence of internal friction on amplitude. Ill 3; Tab 1; Biblio 8.

USSR UDC 669.14:621.9.048.4:620.178.16.4

WEAR PROPERTIES OF STEEL 45 FOLLOWING ELECTROSPARK ALLOYING WITH REFRACTORY METALS, CARBIDES AND HARD ALLOYS

Moscow VESTNIK MASHINOSTROYENIYA IN Russian No 7, 1976 pp 49-51

VERKHOTUROV, A. D., ZEYTSEV, YE. A., and LOPATAY, V. V.

[Abstract] Results are given of a study of the wear resistance of steel specimens hardened with refractory metals Ti, Zr, V, Nb, Ta, Cr, Mo, and W, their carbides, and hard alloys T15K6 and TNM-20. This afforded a most thorough tracking of the influences of the type of material of the alloying electrode on the wear resistance of the hardened layer. It is shown that the relative wear resistance of the hardened specimens is higher than that of the pure electrode materials. With wear-testing machine M22M the highest wear resistance was found in those specimens that were hardened with TNM-20 alloy, which contains no tungsten. With wear-resistance testing machine Kh4-B the highest relative wear resistance was found in specimens hardened with the carbides of the transition elements. Tab 3; Biblio 5.

USSR UDC 678.675

WEAR RESISTANCE OF A GRAPHITE LAYER ON A PHENYLONE BASE

Kiev TEKHNOLOGIYA I ORGANIZATSIYA PROIZVODSTVA in Russian No 10, 1976 pp 59-60 manuscript received 16 Feb 76

SYTAR, V. I., BURYA, A. I., and FOMICHEV, A. I., Dnepropetrovsk Chemical Engineering Institute

[Abstract] A study was conducted as an effort to find composite materials with a phenylone base to operate in friction parts under dry and lubricated

conditions. Those investigated composites had 20% by weight antifriction fillers of various types of natural and synthetic graphites. Tests with specific loads up to 100 kg/cm^2 at sliding rates of 1 meter/sec with a composite made of phenylone S2 plus 20% graphite showed satisfactory results as a dry lubricant. The composite also had excellent physico-mechanical properties: 1,800 kg/cm^2 creep limit in compression; 1,600 kg/cm^2 static bending strength; 25-28 kg·cm/cm^2 specific impact toughness; 290°C heat resistance; 0.16 mg/km wear; and 0.18 - 0.20 friction coefficient. Ill 3; Tab 1; Biblio 2.

USSR UDC 539.4

ON THE QUESTION OF THE HIGH-TEMPERATURE STRENGTH AND DUCTILITY OF MONOCRYSTALLINE MOLYBDENUM DURING PROGRAMMED TESTS

Kiev PROBLEMY PROCHNOSTI in Russian No 10, 1976 pp 32-35 manuscript received 1 Jul 75

BERA, N. D., ZASIMCHUK, YE. E., MARUSIY, O. I., STRIZHALO, V. A., and USKOV, YE. I., Institute of Strength Problems, Academy of Sciences Ukrainian SSR

[Abstract] The temperature dependences of the strength and ductility and the substructural changes of mono- and polycrystalline molybdenum were studied during certain modes of temperature and load variation. It is shown that during extended testing at high temperatures the mechanical properties are determined by the primary recrystallizations that occur under these conditions, rather than by previous treatment and structural peculiarities of the tested material. Ill 4; Biblio 12.

USSR UDC 669.725

STUDY OF THE FRACTURE OF BERYLLIUM CRYSTALS ALONG THE BASAL PLANE

Kiev PROBLEMY PROCHNOSTI in Russian No 10, 1976 pp 63-67 manuscript received 15 Jan 75

PAPIROV, I. I., TIKHINSKIY, G. F., AVOTIN, S. S., and STOYEV, P. P., Physicotechnical Institute, Academy of Sciences Ukrainian SSR, Khar'kov

[Abstract] For single crystals of 99.5% pure beryllium the authors investigated the dependence of the characteristics of fracture along the

basal plane (0001) on orientation. The results obtained were compared with existing models of basal plane cleavage. The experimental data agreed most with the Stroh-Friedel model. The surface energy γ (0001) at 77°K was 750 erg/cm^2. With increased test temperature the normal stress at fracture decreased continuously, whereas the deformation at fracture increased abruptly at temperatures above 600°K. At 643°K the deformation at fracture was 360%. Ill 6; Tab 1; Biblio 20.

USSR UDC 621.787.4:621.921.34

INFLUENCE OF DIAMOND POLISHING MODES ON THE SURFACE CONDITION OF ZHS6-KP ALLOY PARTS

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 4, 1976 pp 41-42

PLESHAKOV, V. V., PERMYAKOV, V. YU., and KUZ'MICHEV, B. P.

[Abstract] Mathematical expressions are derived for the dependence of surface condition and residual stresses on the main factors involved in diamond polishing. An analysis of these relationships can be used as a basis for selecting polishing modes for a desired surface condition. For the ZhS6-KP nickel-base stainless the optimum conditions for the smoothest surface were found to be: 15-25-kg force; 3.0-3.5-mm diamond-tip radius; longitudinal tool feed 0.04-0.07 mm rev. These mode parameters provide a surface condition of $R_a \geqslant 0.020$ micron. Optimum conditions for obtaining the hardest surface of the alloy were: 25-30-kg force; 1.5-mm diamond tip radius; 0.02-0.04 mm/rev longitudinal feed. With these mode parameters a 50% cold hardening was achieved, and the surface layer of the ZhS6-KP alloy withstood compressive stresses of up to 220 kg/mm^2. Ill 2; Biblio 1.

USSR UDC 621.57.041-213.3.313

INFLUENCE OF FREON 22 ON THE ELECTRICAL RESISTANCE OF THE INSULATING FILM IN BUILT-IN MOTORS

Moscow KHOLODIL'NAYA TEKHNIKA in Russian No 10, 1976 pp 33-35

VESELOV, V. V., and PUNIN, V. P.

[Abstract] The resistance of polyethylene terephthalate, polytetrafluoroethylene, and polyfluoroethylene films commonly used to insulate

the motors built into refrigeration equipment is 0.15×10^{13} in air, but drops to 0.02×10^{11} ohms in saturated freon-22 vapors at room temperature. Heating with a 150-watt lamp brings the resistance value up to maximum in air within two minutes, after which the value again decreases gradually and slowly. The reduced resistance value is attributed to the specific resistance of the freon-22 and its adsorption to the surface of the insulating film. Experiments have shown, however, that this reduction of resistance does not lead to a reduction of the breakdown potential of the insulation. Ill 2; Tab 1; Biblio 4.

USSR UDC 678.675'126:539.4

STUDY OF THE EFFECT OF ALTERNATING TEMPERATURES ON THE STRENGTH PROPERTIES OF CAPROLON PARTS

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 3, 1976 p 35

MAKAROVA, M. D., and TAMARIN, V. A.

[Abstract] Tensile, compression, and static bending strength tests were conducted on 600 standard specimens of the polyamide "caprolon" in five temperature-alternation modes covering a total range of +80 to -50°C. In four modes the temperature was held for two hours at every 10°C of change. In the fifth (accelerated) mode the specimens were not held at the extremes (+80°C and -50°C), but were subjected to a constant temperature change of one degree per minute. The greatest reduction of the strength properties of the caprolon occurred in tests with mode 2 (+20 to -10°C). It is pointed out that the designing of caprolon parts for use under variations from above-zero to below-zero temperatures must take into account the fact that these conditions reduce the strength properties of the caprolon by 20%. Ill 3.

USSR UDC 621.9.02.004.6

WEAR MECHANISM OF A CARBIDE TOOL AT HIGH CUTTING TEMPERATURES

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 3, 1976 pp 73-75

GUREVICH, D. M.

[Abstract] In the surface layer of WC-Co tool material cyclic loading causes a plastic deformation of the carbides with the formation of a thin

textured layer. With a build-up of the number of load cycles the force binding the particles of the textured layer to the grain is weakened; as a result of adhesive interaction these two are severed and move to the work material, thereby destroying the grain of the carbides. Basically the mechanism of wear of a carbide tool at high cutting temperatures is the same as at much lower temperatures. The wear resistance of carbides can be increased by increasing the resistance of the carbides to plastic deformation under the effect of cyclic loading. Ill; Biblio 5.

USSR UDC 666.9

BINDERS AND CONCRETES BASED ON NICKEL SLAGS

Moscow STROITEL'NYYE MATERIALY in Russian No 10, 1976 pp 14-15

SUVORVA, G. F., Leningrad Construction Engineering Institute

[Abstract] Data are given on the properties of mixed binders obtained by pulverizing nickel refuse slag and adding hardening agents. With such nickel slag binders, plus portland cement, lime, or gypsum, it is possible to produce heavy concretes with compressive strengths of 200-600 kg/cm^2. The chemical compositions of nickel slags from seven different USSR nickel smelters are given. The results of tests with nickel slag binders justifies the organization of the production of local building materials on the basis of the nickel slags available in the respective areas. Ill 4; Tab 1; Biblio 5.

USSR UDC 621.039.532

THE NATURE AND THERMAL STABILITY OF RADIATION-INDUCED DEFECTS IN ZIRCONIUM HYDRIDE

Moscow ATOMNAYA ENERGIYA in Russian No 4, 1976 pp 289-292 manuscript received 9 Jul 76

PINCHUK, P. G., BYKOV, V. N., BIRZHEVOY, G. A., ALEKSEYEV, YU. V., VAKHTIN, A. G., and SOLOV'YEV, V. A.

[Abstract] Defects in zirconium hydride $ZrH_{1.9}$ arter irradiation by a neutron flux of $3.2 \cdot 10^{21}$ n/cm^2 at 50°C were investigated by measurements of electrical resistance, density, microhardness, heat conductivity,

interatomic distances and by electron microscope. A swelling of 1.31% is associated with the accumulation of vacancies and their fine complexes. The effect of metallic and hydrogen sub-lattice defects on the physical properties investigated is evaluated. Three stages of annealing of the radiation-induced defects were found in the temperature interval 50-600°C, corresponding to three types of radiation defects with activation energies of 0.25±0.05, 1.35±0.1 and 1.54±0.2 ev, respectively. The extreme changes of microhardness and phonon component of heat conductivity during the annealing are associated with the formation of defect complexes. It is shown that re-establishment of the hydrogen sublattice occurs during the second and third stages of annealing of the hydrogen defects. The melting point of the $ZrH_{1,9}$ is shown to be 2,155±75K. Ill 3; Tab 2; Biblio 15.

USSR UDC 621.391.828.088:621.317.39

ON AN ANALYSIS OF ADAPTIVE MEASUREMENT OF A PARAMETER DURING COMMUTATION NOISES

Leningrad TRUDY. LENINGRADSKIY INSTITUT AVIATSIONNOGO PRIBOROSTROYENIYA [Works. Leningrad Institute of Aviation Instrument Construction] in Russian No 101, 1975 pp 81-83

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 9, 1976 Abstract No 9.32.69]

IVANOV, B. F., and SUMERIN, V. M.

[Text] It was shown that the presence of commutation noises in a communication channel sharply increases the probability of large errors and leads to significant errors in measurement of the parameter. An expression obtained for estimating the error in measurement and a method is proposed for suppressing such noise by adaptive variation by the signal energy. References 3.

USSR UDC (533.21+532.137)001.2

EXPERIMENTAL STUDY OF COMPRESSIBILITY AND VISCOSITY OF HELIUM AT LOW TEMPERATURES AND HIGH PRESSURES

TEPLOFIZ. SVOYSTVA GAZOV in Russian Moscow, Nauka Press, 1976 pp 11-13

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 12, 1976 Abstract No 12.32.1236]

TSEDERBERG, N. V., POPOV, V. N., KALENKOV, A. B., and PANCHENKO, S. S.

[Text] The constant volume piezometer method is used to measure the compressibility of helium in the 55-273 K interval at pressures up to 100 MPa with an error of 0.15%. The viscosity of the helium is measured by the method of attenuation oscillations of a cylinder in the 80-273 K and 0.1-67 MPa interval. Measurements are performed as relative measurements with a mean error of $\pm$2.5%. Tables 2; References 6.

USSR UDC 531.768.082.73

MEASUREMENT OF THE RELATIVE TRANSVERSE CONVERSION FACTOR OF A PIEZOELECTRIC ACCELEROMETER FROM THE ELECTRIC SIDE

VIBRATSION. TEKHNIKA in Russian Moscow 1976 pp 28-31

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 12, 1976 Abstract No 12.32.577 by Ye. A. Zlotina]

KOZLOV, V. V.

[Text] In contrast to known methods of measurement of the relative transverse conversion factor (OKPP) when the vibration measurement converter (VIP) is acted upon from the mechanical side sequentially in the longitudinal direction and by a transverse harmonic vibration, and the output signal is measured from the electrical side, a study is made of a measurement method in which operations with the VIP are performed only on one side--the electrical side. It is simpler to study the VIP from the electrical side, since the electronic apparatus and electric measurements are better developed, accuracy achieved is higher than the corresponding values for measurement of mechanical quantities. The possibility in principle of determining the characteristics of a piezoelectric VIP by measurements from the electrical side results from its reversibility. A study is made of particular cases of determination of the value of OKPP from the results of measurements of equivalent parameters of the VIP from the electrical side. A general formula is presented, relating the OKPP to the parameters of the VIP, the possibility is shown in principle of finding the value of the OKPP from measurements from the electrical side in particular cases. References 4.

USSR UDC 533.6.011

METHOD OF DESIGN OF TRANSSONIC FLOW USING INTERFEROMETRIC MEASUREMENTS

VSES. SIMPOZ. PO METODAM AEROFIZ. ISSLED., 26-29 APR. TEZISY DOKL.in Russian Novosibirsk 1976 140 pp

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B203 by O. K. Rozanov]

NEVSKIY, L. B.

[Text] A method is suggested for calculating the parameters of transsonic flows using interferometric measurements. The density is calculated by means of the measured deformation of the wave front m of beam of light

and calculation of the derivatives of m. By means of these quantities, the unknown coefficients of the analytic function which approximates the distribution of density are found. To calculate the temperature, a function is found relating the temperature and density. Testing of the efficiency of this function has shown that it is usable with slight changes in pressure within the limits $\Delta P/P_\infty \simeq 2.5$. Based on values of density and temperature using the equation of state of the gas, values of pressure are determined, then other parameters of the gas flow are found. Examples are shown of calculation of the flow near various models located in the free stream. Experimental data are presented, confirming the suggested method of calculation.

USSR UDC 620.179.16

A METHOD OF DETERMINING THE COEFFICIENT OF ANISOTROPY OF THE MECHANICAL PROPERTIES OF FIBER MATERIALS

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 39, 25 Oct 76 p 102 Author's Certificate No 532804 filed 1 Apr 75

RUDNEV, A. D., KUNDZICH, G. A., FOMENKO, V. A., and SIDORCHENKO, P. M., Ukrainian Scientific Research Institute of the Paper and Pump Industry

[Text] This Author's Certificate introduces a method of determining the coefficient of anisotropy of the mechanical properties of fiber materials that is based on Author's Certificate No 358663 and is distinguished by an increase in accuracy through additional measurement of the attenuation factors of ultrasonic Lamb waves in the longitudinal and transverse directions with calculation of the coefficient of anisotropy by the formula

$$K = \alpha_1 \frac{C_1}{C_2} + \alpha_2 \frac{\gamma_2}{\gamma_1},$$

where k is the coefficient of anisotropy of mechanical properties, α_1 and α_2 are the regression coefficients of the material in the longitudinal and transverse directions respectively, C_1 and γ_1 are the rate of propagation and attenuation factor of ultrasonic Lamb waves in the longitudinal direction, and C_2 and γ_2 are the corresponding speed and attenuation factor in the transverse direction.

USSR UDC 621.384.3.001.24

CALCULATION OF THE TRUE TEMPERATURE OF AN OBJECT BY IR MEASUREMENT

Moscow OPTIKO MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 10, Oct 76 pp 8-9 manuscript received 4 Nov 75

SOBOLEVA, N. F.

[Abstract] A study is made of the problem of determining the true temperature of an object by means of IR radiometry. A study is made of the influence of the radiation factor of the object and the ambient temperature on the measurement error. The results of the calculation for the 290-573 K range are presented graphically. The final simplified formula for determination of the correction presented in an earlier work by the same author yields an elevated value and should not be used. If the radiation temperature of the object is between the background temperature and 373 K, which is characteristic for most microelectronics elements, the method presented in another work [Elektronnaya Tekhnika, Series 8, 1975, No 3, p 76] is not suitable and the graphic method suggested in this article must be used for determination of the correction. When studying objects with a radiation temperature of over 373 K, the influence of background temperature become insignificant and values of the correction produced by the method suggested in this article and in the article just mentioned are similar, so that either can be used. References 2.

USSR UDC 534.78

A METHOD OF MEASUREMENT OF THE FORMANT FREQUENCY OF A SPEECH SIGNAL

OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 42, 1976 p 134 Item No 535592

RYZHIKOV, V. V., Minsk Electronic Institute

[Text] A method of measurement of the formant frequency of a speech signal, based on separation of the formant area, is distinguished by the fact to simplify the device, the formant oscillations separated are normalized as to their maximum with a time constant located between the length of the shortest speech sounds and the longest period of the base tone, the normalized signal is differentiated and the maximum value of the trailing edge of the half wave used for normalization is utilized to judge the formant frequency.

USSR UDC 536.24

A METHOD OF DETERMINATION OF THE CONVECTIVE HEAT TRANSFER FACTOR α

OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNARKI in Russian No 42, 1976 p 100 Item No 535491

TSIREL'MAN, N. M., Ufa Aviation Institute

[Text] A method of determination of the convective heat transfer coefficient α by placing a heat receiving element in the medium to be studied and measuring temperature changes in it considering the regularities of the thermal mode regulated is distinguished by the fact that to increase the accuracy, rate V of displacement of the isotherm from the heat exchange surface is measured, for example by measurement of the surface temperature and temperature of the body at a known distance in its immediate vicinity, then the desired coefficient is calculated using the formula

$$\mu_1^2 B_i^{-1} = V l_0 a^{-1},$$

where $B_i = \frac{a l_0}{\lambda}$ is the criterion of biot; μ_1 is the first root of the characteristic problems of heat conductivity dependent on biot and the form of the heat receiving element; t_0 is the characteristic dimension of the element; α and λ are the coefficients of temperature and heat conductivity of the element.

USSR UDC 533.6.011.8

PROCESSING OF DATA OF FLIGHT TIME MEASUREMENTS OF MOLECULAR BEAMS BY THE METHOD OF REGULARIZATION

VSES. SIMPOZ. PO METODAM AEROFIZ. ISSLED., 26-29 APR. TEZISY DOKL. in Russian Novosibirsk 1976 p 147

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B280 by A. L. Stasenko]

KOLOSOV, A. V., and SEDEL'NIKOV, A. I.

[Text] A study is made of a problem relating to the class of imprecisely stated problems, the solution of which is related to analysis of the integral Fredholm equation of the first kind and is quite sensitive to imprecision in the right portion (determined experimentally) and initial conditions. A computer is used to restore the distribution function of molecules by

velocities f(v) based on flight time measurement data I(t) considering the modulation function $A(\tau)$, detector length x_2-x_1 and the relaxation time of the detector and its electronic circuit τ_e. The method of statistical regularization is used to solve the following equation for f(v):

$$\text{const}\int_0^{\theta} A(\tau)\int_{x_1}^{x_2}\frac{x^3}{(t-\tau)^4} f\left(\frac{x}{t-\tau}\right) dx\,d\tau = I(t)+\tau_e\frac{dI(t)}{dt}$$

Signal I(t) from molecular beams, formed by means of a gas dynamic source, is processed. A study is made of the influence of the parameters of the problem on accuracy of restoration of f(v). For various pressures in the prechamber of the source, f(v) and its basic moments n, u, T are defined. It is shown that where M>5, the f(v) produced is well approximated by the maxwell function, but where M<4 it differs from it.

USSR UDC 621.317.3087. 2.088

THE PHENOMENON OF MECHANICAL CAPTURE IN STRING DIFFERENTIAL CONVERTERS

SAMOLETOSTR. TEKHN. VOZDUSH. FLOTA. RESP. MEZHVED. TEMAT. NAUCH.-TEKHN. SB. in Russian No 39, 1976 pp 15-18

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 12, 1976 Abstract No 12.32.144 from the resume]

BREKHIN, N. I., and SUBBOTA, A. M.

[Text] A study is made of the influence of the mechanism of mutual influence of strings or the influence of "capture" on the threshold of sensitivity of string differential converters. An equation is produced defining the development of parametric oscillations of the second string under the influence of the first:

$$\omega_2 = \frac{4\omega_1 P_{\text{кр}}}{4P_{\text{KD}} \pm P_{10}},$$

as well as an equation determining the minimum value of force at which the phenomenon of "capture" develops:

$$P_{\min} = \frac{lm}{\pi^2}\cdot\frac{C_0^2+8C_0\omega^4}{16\omega_0^6}$$

Figures 2; References 2.

EAST GERMANY

THE EFFECT OF CONFIGURATIONAL AND POSITIONAL DEVIATIONS ON THE UNCERTAINTY OF COMPUTER-ASSISTED COORDINATE MEASUREMENT

East Berlin FEINGERAETETECHNIK in German Vol 25, No 8, 1976 pp 344-349

LOTZE, W., professor, Dr of engineering, and TEICHMANN, U., Dr of engineering, Fabricating Engineering and Machine Tool Section; Area: Fabrication Metrology, Dresden Technical University

[Abstract] The relationship between the configurational and positional deviations of the workpieces, and the measurement errors that occur are illustrated on the basis of examples concerning errors that arise in the workpiece testing by means of coordinate measurement with computer assistance. Two major conclusions are found: 1) The pairing geometry must be taken into consideration in the development of algorithms for the evaluation of the coordinate measurements; 2) The simple error theory is inadequate for the calculation of the measuring uncertainty because of configurational and positional deviations, since there is correlation between the measurement points. The examples discussed demonstrate the order of magnitude of the so far overlooked effects of error propagation in coordinate measurements; they also point out the necessity for further studies and the introduction of the results of theoretical studies into practice. Figures 9; references 8: all German.

EAST GERMANY

SYSTEMATIC MEASURING ERRORS OF ELECTRICAL PRESSURE GAUGES AND MEANS FOR REDUCING THEM

East Berlin FEINGERAETETECHNIK in German Vol 25, No 8, 1976 pp 365-370

STEIN, H., Dr of engineering, Information Technology Section, Dresden Technical University

[Abstract] The operation and major systematic measuring errors of conventional direct-acting force-compensation pressure transducers were discussed. Experimental studies indicated errors caused by creep and aftereffect factors, except in the case of force-compensation transducers with metallic pressure sensors. These factors are not negligible when higher accuracies are aimed for with the use of process computers. A new operating principle was presented in two versions for the improvement of the electric pressure transducers used so far. One of these versions permits compensation of creep and hysteresis errors without requiring unduly complex construction. A model was described for the increasing of measuring accuracy by subsequent error correction; it considers the error behavior of electric pressure transducers and the theory of error correction. Figures 8; references 10: 8 German, 1 Russian, and 1 Western.

USSR

UDC 624.131+539.215

ON AN ESTIMATE OF THE CONVERGENCE OF THE VARIATIONAL-DIFFERENCE METHOD IN SOLVING PROBLEMS OF ELASTIC DEFORMATION OF A MASSIF

Apatity PROBLEMY IZUCHENIYA I OSVOYENIYA PRIRODNYKH RESURSOV SEVERA [Problems of Studying and Mastering Natural Resources of the North, Collection of Works] in Russian, 1975 pp 36-40

CHERNOV, YE. V. and ZHUKOV, V. V.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9V625 by P. F. Sabodash]

[Text] The authors propose a mathematical model, which by use of the variational-difference method of the theory of elasticity, permits investigating elastic equilibrium of a nonhomogeneous rocky massif, weakened by mining. Use of this method is based on the concept of a region of the massif with a set of triangular elements, the potential energy of each cell P being equal to the difference between the internal energy of cell deformation V and the work of the external forces A applied to the elementary cell. For the internal cells of the region the quantity A is equal to the energy of the gravitational forces; for cells adjacent to the boundary of the region, one adds still the energy of the surface forces (reactions of stress, tectonic forces, etc). The internal energy of deformation of the cell, expressed through the modulus of shift of the rock G and its Poisson coefficient ν, is the quadratic form of the deformation components in the Cartesian coordinate system. The partial derivatives of the elastic shifts over the spatial coordinates are replaced by their finite-difference analogs and summation is done over all cells of the region. Minimization of the total potential energy P over the elements leads to a system of linear algebraic equations of the order N_1+N_2, where N_1 and N_2 are the number of unknown horizontal u_i and vertical v_i shifts at the nodal points. The authors analyze questions of convergence and accuracy of the solutions in selecting the size of the step in the computational grid. They demonstrate that in the practical realization of the procedure developed by the authors it follows to use the necessary condition of stability of R. Kurant, in accordance with which as stability of the step of the grid they use a quantity that is inverse to the largest relative gradient of change in the unknown function in a direction determined by a straight line connecting the corresponding nodes of the grid. As an example they examine a problem on elastic equilibrium of a uniform massif in which isolated mining has occurred. The mixed boundary problem of the static theory of elasticity in a rectangular coordinate system x and y is solved in three stages. In the first stage the region around the mine is divided into a set of triangular elements with large cell size which led to the necessity of solve a system of 252 linear algebraic equations on a computer. In the next two stages the size of the cell was

decreased each time 1.5-2 times. Comparative analysis of the shifts at characteristic points around the mine and on its surface at all three stages of the solution showed that a good convergence of the computational results can be obtained even at the first stage (average accuracy is 10%), whereas the second and subsequent stages are used only in the case of necessity for a more detailed examination of the field near the concentrator (mine) or at the boundaries of change in the properties of the component massifs of rock. The numerical results for the shifts obtained with relative values of the physical parameters of the medium $G = 1$, $\nu = 0.25$, and $\gamma = 1$ (specific weight), are presented in the form of tables. The authors mention the advantages of the variational-difference method and its prospects for computing the stress-strain state of rocks.

USSR UDC 550.839.622.241

A DERIVATIVE PARAMETER COMPUTER FOR GAS WELL LOGGING

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 39, 25 Oct 76 p 109 Author's Certificate No 532837 filed 27 Dec 74

MADZHAROVA, V. I., GRAVCHEV, YE. M., POMERANTS, L. I., VEKSLER, V. YE., BUTYUGINA, L. P., CHAYKINA, L. I., DUBROVINA, G. V., and PECHKOV, A. A., All-Union Scientific Research Institute of Geophysical Prospecting Methods

[Text] This Author's Certificate introduces a derivative parameter computer for gas well logging that includes an arithmetic unit, an immediate-access memory, a device for converting chromatographic data to digital form (such as a unit that determines the maxima of peaks of the chromatogram or an integrator), a master clock, an input module, a device that ties in true depth signals with the analysis cycle of the chromatograph, a scale converter, and a recorder with tape transport controm mechanism. As a distinguishing feature of the patent provisions are made for increasing the speed of determining and recording the set of parameters needed for predicting gas and petroleum strata as a function of true well depth before these strata are opened by the well, and for dynamic determination of the nature of saturation of strata opened by the well. The computer contains a cumulative counter of chromatographic data, a cumulative counter for determining the duration of drilling one running meter of well depth as a function of true depths, a cumulative counter that determines the coefficient of dilution as a function of true depths, a buffer memory, a device for determination of the index of component makeup of the gas in a stratum, a program-interrupting device, a clock-phase network, a

control device and a control panel. One input of the arithmetic unit is connected to the control panel through the input module, a second is connected to the output of the cumulative counter for chromatographic data, a third is connected through the buffer memory to the cumulative counter for determining the coefficient of dilution as a function of true depths, a fourth is connected to the immediate-access memory, and a fifth is connected to the control device; one output of the arithmetic unit is connected to the recorder through the scale converter, a second is connected to the immediate-access memory, and a third is connected to the recorder through the device for determination of the index of component makeup of the gas in a stratum. One input of the control unit is connected to the program-interrupting device, a second is connected to the master clock via the clock-phase network, and a third is connected to the control panel; one output of the control unit is connected to the buffer memory, a second is connected to the immediate-access memory, a third is connected to the recorder tape transport control mechanism, a fourth is connected to the scale converter, and a fifth is connected to the device for determination of the index of component makeup of the gas in a stratum. The cumulative counter for determining the duration of drilling one running meter of well depth as a function of true depths is connected to the recorder through the buffer memory. The device that ties in true depth signals to the chromatograph analysis cycle is connected to the clock-phase network and to the device for converting chromatographic data to digital form. One input of this conversion device is connected to the cumulative counter for chromatographic data, and another input is connected to the program-interrupting device. The recorder is connected to the program-interrupting device.

USSR UDC 621.391.26:621.383.4

PROBABILITY OF ERRORS IN A SCANNING OPTICAL-ELECTRONIC INSTRUMENT WITH A MULTIPLE-ELEMENT PHOTORECEPTOR

Moscow OPTIKO MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 10, Oct 76 pp 3-7 manuscript received 6 Feb 76

DEMIDOV, YE. F., and SHARKOVA, E. V.

[Abstract] Based on the theory of statistical decisions, formulas are produced for determination of the probability of error in an optical-electronic scanning instrument with a multiple-element photoreceptor, used with any number of photoreceptor elements having variable geometric dimensions and any density of distribution of the coordinate of a small dimensional target. Analytic formulas are presented and probability of omission produced for particular cases. The expressions necessary to estimate the probability of error using Bayes-type criteria, as well as Neuman-Pierson criteria are produced for a single channel of an optical-electronic instrument; another formula is suitable for calculation of the probability of omission with any number of elements, any known rule of change of parameters of the receptor and size of the image. Conditions are found under which the probability of omission of the signal is approximately equal to the probability of omission when a target enters a zone corresponding to the spatial period of the photoreceptor. The analysis performed provides the requirements for receptor geometry on the basis of fixed values of error probability and signal/noise ratio. References 6.

USSR UDC 535.317.7

STUDY OF IMAGE QUALITY OF OPTICAL SYSTEMS BY THE METHOD OF ISOPHOTOMETRIC PHOTORECORDING

Moscow OPTIKO MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 8, Aug 76 pp 14-17 manuscript received 17 Oct 75

ZVEREV, V. A., KIRILLOVSKIY, V. K., and SOKOL'SKIY, M. N.

[Abstract] The purpose of this work was development of a method of isophotometric photorecording, allowing production of the topography of distribution of illumination in a scattering spot with a change in level of illumination reaching four orders of magnitude and more, as well as curves of distribution of illumination in any cross section of the

scattering spot, and to calculate the relative distribution of energy in it. The method developed for isophotometric photorecording allows the production of a topogram of the distribution of illumination over a given sector of a two-dimensional optical image in the form of lines of equal levels of illumination. The method is distinguished by its simplicity, clarity, very high sensitivity and broad range of measured quantities, great information content, high ratio of signal to photographic noise, low level of error, which is easily analyzed and considered. With dimensions of the analyzed element of the enlarged image of 1 mm, the accuracy of isophotometric measurement is 2%. References 8.

USSR UDC 621.391.232:535.81

INFORMATION CONTENT OF THE OPTICAL IMAGE IN OPTICAL-ELECTRONIC INSTRUMENTS

Moscow OPTIKO MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 8, Aug 76 pp 11-14 manuscript received 12 Nov 75

MOLODYK, A. V., and KONOPAL'TSEVA, L. I.

[Abstract] Discretization of a function limited by a band of spatial frequencies is used to produce the dependence of entropy of the two-dimensional image in optical-electronic devices and information content of monochrome and color systems. The cases of limitation of the optical system by diffraction and finite aberrations are analyzed, as well as limitation by noise with the standard distribution. The information content of an image in long wave communications channels limited by diffraction is significantly less than in short wave channels. Therefore, the total mean entrophy of a "three color" system consisting of such channels differs little from the entropy of the image of the short wave channel alone. The weight share of information content of various channels in a multicolor optical system changes significantly when we consider the energy parameters of the signal and the "information value" of the long wave channel may be found to be greater than that of a short wave channel. The information content of images created by an actual optical system limited by aberrations may be significantly less than the theoretical limit and practically equal for all colors. In this case, the "information value" of channels depends basically on the energy parameters of the signals in each channel. It is noted that for the class of linear optical systems in question, the limitation of information is determined by the transmission band of spatial frequencies (space-frequency characteristics), geometric characteristics of the optical system (field of vision, aperture, focal length), energy characteristics of the signals (fluctuation in illumination of image, caused, for example, by photon noise). References 4.

USSR

UDC 539.211

CRYSTALLINE FILM ON POLISHED SURFACES

Moscow OPTIKO MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 10, Oct 76 pp 30-35 manuscript received 17 Jun 75

SEGAL', V. M., BOLOTOV, I. YE., RABINOVICH, L. V., LIBERMAN, R. YA., and ZHUKOVA, L. P.

[Abstract] The method of electron microscope replicas is used to establish that a water-soluble crystalline film is formed on the working surfaces of K8 glass elements. Direct observation and model experiments show that the main reason for the formation of the film is leaching. A technology is suggested and experimentally tested for production of products with deep optical contact but free of the film. References 5.

USSR UDC 539.375

DEVELOPMENT OF A CRACK IN A LAYERED COMPOSITE

Moscow TRUDY MOSKOVSKOGO ENERGETICHESKOGO INSTITUTA [Works of Moscow Energy Institute] in Russian, No 280, 1976 pp 38-43

PARTSEVSKIY, V. V. and BLYUDOV, S. V.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9V562 by P. F. Koshelev]

[Text] The authors investigated the possibility of appearance of secondary cracks -- scaling cracks for a discrete model of a composite on the basis of a previously solved problem on the concentration of stresses near the crack, normal to the layers. They present the numerical solution. They show that the maximum values of membrane and bending stresses are reached, just as in a material without secondary cracks, at the end of the crack. They note that with the appearance of secondary cracks all stresses in the hazardous points are reduced. The suggested method does not permit obtaining the critical length of the secondary crack.

USSR UDC 539.385

ON THE QUESTION OF A STATISTICAL MODEL OF FATIGUE FRACTURE

Kuybyshev TRUDY KUYBYSHEVSKOGO AVIATSIONNOGO INSTITUTA [Works of the Kuybyshev Aviation Institute] in Russian, No 77, 1975 pp 27-31

DUPLYAKIN, V. M. and MOSTOVOY, A. S.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9V1144 by the authors]

[Text] Questions are examined which deal with the transition from a deterministic to a statistical model of fatigue fracture. As the deterministic solution a model is used which is constructed on the basis of linearly discrete concepts on the mechanism of accumulation of fatigue damages. The statistical interpretation of the given solution includes random selection for each filament of the fatigue curve from the family $N-\sigma-P$. The statistical computation made of the distribution functions of the lifetime of flat samples with an opening from AMG-6M material under tension-compression satisfactorily agrees with the respective experimental data.

USSR UDC 669-12/.13.001.24

ELASTIC-PLASTIC COMPRESSION OF A THIN HARDENING STRIP WHEN THERE IS AN AREA OF CREEP

Moscow PLASTICHESKOYE DEFORMIROVANIYE METALLOV (Plastic Deformation of Metals -- Collection of Works) 1974 in Russian pp 14-29

TRET'YAKOV, Ye. M.

[Abstract] A solution is presented to the two-dimensional problem of elastic-plastic compression of a thin, plastically hardening strip under conditions of planar deformation. The diagram of the dependence of the intensity of stress σ_i on intensity of deformation ε_i of the deformed material in question consists of a sector of linear elasticity, an area of creep and a sector of exponential plastic hardening. The value of Poisson's coefficient is assumed equal to 0.5. A case is studied in which there is a central, ideally plastic layer and outer plastically hardening areas in the deformed strip. Necessary and sufficient conditions are defined for this solution. The distribution of stresses and deformations and the distribution of σ_i and ε_i through the cross section of the strip in question are determined. The theorem of unloading is used to determine the residual stresses in the thin hardening strip when it contains a central ideally plastic layer. References 11: 10 Russian, 1 Western.

USSR UDC 669-12/.13.001.24

DYNAMIC COMPRESSION OF THICKWALL CYLINDRICAL BLANKS

Moscow PLASTICHESKOYE DEFORMIROVANIYE METALLOV (Plastic Deformation of Metals -- Collection of Works) 1974 in Russian pp 42-50

SHCHEGLOV, B.A.

[Abstract] A study is made of the process of dynamic compression of a thickwall cylindrical blank of a rigid-viscous-plastic metal, occurring under conditions of axisymmetrical deformation. Relationships are presented for determination of the stresses operating in the blank, the distribution of rates and deformations, and calculation of the energy of plastic deformation. References 6: all Russian.

USSR UDC 539.376+532.135

MODELING OF ISOTHERMAL PROBLEMS OF THE HEREDITARY THEORY OF CREEP

POLYARIZATSIONNO-OPTICH. METOD I YEGO PRIL. K ISSLED. TEPLOV. NAPRYAZH, I DEFORMATSIY in Russian, Kiev, Nauk. Dumka Press 1976 pp 19-22

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12V474 by M. I. Rozovskiy]

AVANESOV, YU. L.

[Text] It is shown that linear integral operators with arbitrary time scale $\xi(t)$ such as

$$Kf = \int_{0^-}^{t} K[\xi(t) - \xi(\omega)]\, \dot{f}(\omega)\, d\omega$$

can be used to model nonisothermal quasistatic mixed linear hereditary creep theory problems. The conditions of this modeling are

$$\nu_{\text{н}}^{c} = \nu_{\text{м}}, \quad K_{\sigma} = K_{l} E_{\text{н}}^{c} E_{\text{м}}^{-1}, \quad K_{\varepsilon} = K_{l} = K_{\varepsilon T}$$
$$K_{\varepsilon} = c_{\alpha} K_{T}, \quad K_{u} = c_{l} K_{\varepsilon}, \quad K_{\sigma 0} = K_{\sigma}, \quad K_{u\vartheta} = K_{u}$$

Here E_H, ν_H and E_M, ν_M are the integral operators for nature and model respectively, operators K_f ($f=\sigma,\ell,\ldots$) such as K, c_α and c_ℓ are the proportionality coefficients. The condition $\nu_H(c\xi) = \nu_M(\xi)$ is placed on the model material. The operator of normal deformation E and operator Poisson coefficient ν figure in the initial rheological equation.

USSR

ON THE MAGNETOELASTICITY EQUATIONS FOR THIN SPHERICAL SHELLS

Yerevan IZVESTIYA AN ARMYANSKOY SSR MEKHANIKA in Russian No 5, 1976 pp 28-41 manuscript received 4 Jun 76

BAGDASARYAN, G. YE., and MKRTCHYAN, P. A., Institute of Mechanics, Academy of Sciences Armenian SSR

[Abstract] On the basis of the hypothesis of thin body magnetoelasticity the three-dimensional problem of the magnetoelasticity of spherical shells is reduced to a two-dimensional problem, thus facilitating essentially the investigation of the magnetoelasticity problem for the shells under consideration. By means of the two-dimensional equations derived by the

authors the influence of both the electroconductivity of the shell material and of the given magnetic field intensity on the mode of elastic vibration of the shell is considered for the case of a radial magnetic field effect. Ill 5; Biblio 6.

USSR UDC 624.073.074.075.04:539.374

ON THE STABILITY OF AN I-BEAM FLANGE UNDER UNEVEN COMPRESSIVE LOADS

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 5, 1976 pp 41-43

BROUDE, B. V., and MOISEYEV, V. I.

[Abstract] The I-beam flange subjected to uneven compression is treated as a plate with two free parallel edges hinge-supported along the median line. A bifurcated load within and beyond the elasticity limit is studied. The method applies relationships of the theory of small elastic-plastic deformation for an incompressible material, the Shelley-Stowell conception (absence of unloading at the moment of bifurcation), and the energy criterion of stability. A considerable increase in the critical load in comparison with the case of free projection is apparent. Results of calculations show that accounting for the stabilizing effect of the less heavily loaded part of an unevenly compression-loaded I-beam allows a considerable increase in the permissible width of the flange. Tab 3; Biblio 5.

USSR UDC 539.3:624.074.4

STUDY OF THE STRENGTH OF A CYLINDRICAL SHELL DURING LOCAL INTERACTION WITH A NONLINEAR CIRCULAR SUPPORT

Kiev PROBLEMY PROCHNOSTI in Russian No 10, 1976 pp 26-31 manuscript received 16 Jun 75

IVCHENKO, YE. V., and MAKEYEV, YE. M., Dnepropetrovsk Department, Institute of Mechanics, Academy of Sciences Ukrainian SSR

[Abstract] The authors consider a thin-walled cylindrical shell reinforced by a series of ribs and exposed to local transverse loading by radial and tangential loads applied against the ribs. At one of the ribs the shell

is supported on a double, arbitrarily positioned, curved-surface base. The base and shell are in contact through a nonlinearly elastic cushion not attached to the shell. The stability of the shell takes into account the unidirectional action of the cushion and the nonlinearity of the relationship of reactive force to displacement. The problem of the stressed condition of the shell is solved in trigonometric series and with certain assumed simplifications. A description is given of an algorithm for solving the nonlinear contact problem by the method of successive approximations. An analysis of the influence of the characteristics of the piecewise linear cushion on the contact pressure and bending stresses in the shell near the curved support is given as a concrete example. Ill 5; Biblio 4.

USSR UDC 539.357:620.17:620:19

STRESSED CONDITION OF CRACKED DISKS RECOMMENDED AS SPECIMENS FOR CRACK PROPAGATION RESISTANCE STUDIES IN MATERIALS

L'vov FIZIKOKHIMICHESKAYA MEKHANIKA MATERIALOV in Russian No 4, 1976 pp 25-39 manuscript received 4 Feb 76

YAREMA, S. YA., Physicomechanics Institute, Academy of Sciences Ukrainian SSR, L'vov

[Abstract] The article is based on past work of the author and her associates and gives for the two-dimensional case the integral equations for a disk with arbitrarily oriented crack and considers their solutions for certain types of loads from the point of view of the use of the disks as specimens for the study of the crack resistance of various materials. Certain practical hints are given, and a nomogram is plotted for selecting the optimum dimensions of a specimen for studying subcritical crack growth, with the influence of method of clamping the specimen in the testing machine taken into account. Ill 9; Tab 1; Biblio 26.

USSR UDC 539.377

NON-STATIONARY THERMOELASTICITY PROBLEM FOR A CRACKED PLATE WITH HEAT ELIMINATION FROM THE SIDE SURFACES

L'vov FIZIKOKHIMICHESKAYA MEKHANIKA MATERIALOV in Russian No 4, 1976 pp 73-78 manuscript received 15 Aug 75

KIT, G. S., and POBEREZHNYY, O. V.

[Abstract] A description and method of solution are given for time-dependent two-dimensional thermoplasticity problem of a plate with a crack. It is assumed that between the plate and ambient medium there is heat exchange according to Newton's law and that the temperature or heat flux at the edges of the crack are given. The thermoelastically and thermal conductivity problems are reduced to a solution of dual integral equations. Formulas are derived for determining the stress intensity factors in the case when the given values are constant. Ill 2; Tab 1; Biblio 8.

USSR UDC 624.075.04:539.374

ON THE BUCKLING OF STRUCTURES DURING CYCLIC LOADING BEYOND THE ELASTICITY LIMIT

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 5, 1976 pp 49-51

RAKOVSHCHIK, YU. A.

[Abstract] Author considers the problem of the buckling under cyclic stresses in the elastic-plastic region by rods, plates and shells that have initial imperfections (form defects, off-center load application). It is shown that the loss of stability may occur during loads that are lower than the critical loads for static loading. In such a case, for an arbitrary value of external loading (applied within a certain interval of values) there is a corresponding critical number of cycles beyond which the system loses stability. Results are given of experimental determinations of the critical number of cycles for rods during cyclic loading. It is shown that when the load cycle is asymmetrical the critical number of cycles, other things being equal, depends on the magnitude of the asymmetry, whereas when the asymmetry value and load value are functions of the number of cycles, the critical number of cycles depends also on the type of corresponding functions. Ill 4; Biblio 7.

USSR UDC 629.7.036.3.001-2

ESTIMATE OF THE OPTIMAL (FOR OBTAINING MAXIMUM SPECIFIC THRUST) OF THE GAS TEMPERATURE AT INTAKE OF A TURBINE TURBOJET ENGINE BY ALLOWING FOR COOLING LOSSES

Ufa TRUDY UFIMSKOGO AVIATSIONNOGO INSTITUTA [Works of Ufa Aviation Institute] in Russian No 96, 1975 pp 68-72

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.62 resume]

AKSEL'ROD, S. YE., and USTYUGOV, V. I.

[Text] The authors examine the influence of the increase in gas temperature at a turbine intake on the amount of specific thrust of a turbojet engine by allowing for cooling losses. The dependence of the relative air consumption, removed at the compressor outlet for cooling, on the gas temperature is presented for the extreme cases by approximating polynomials; the amount of work, completed in the turbine by the cooling air, is taken into account using a single average coefficient of losses. It was demonstrated that an optimal value exists for the temperature at the intake of the turbine, corresponding to the maximum of specific thrust. A formula is given for computing the optimum intake gas temperature, T_{3opt}. In the examined examples the value of T_{3opt} was found to be lower than that corresponding to the stoichiometric composition of the kerosene-air mixture. Figures 2.

USSR UDC 621.438:621.43

SELECTING THE OPTIMUM RATIO BETWEEN PISTON ENGINE POWER AND EXCESS POWER OF THE EXHAUST TURBINE IN A DIESEL-TURBINE UNIT WITH AFTERBURNER

DVIGATELI VNUTRENNEGO SGORANIYA. RESPUBLIKANSKIY MEZHVEDOMSTVENNYY TEMATICHESKIY NAUCHNO-TEKHNICHESKIY SBORNIK [Internal Combustion Engines. Republic Interdepartmental Thematic Scientific and Technical Collection] in Russian No 23, 1976 pp 3-9

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 10, 1976 Abstract No 10.49.148]

SHOKOTOV, N. K., LEVKOVICH, S. L., GUBIN, A. I., and SEMENOV, V. G.

[Text] A technique is presented for mathematical modeling on a digital computer and physical simulation in an experimental department of the working conditions of a diesel-turbine unit with power turbine and afterburner. The paper gives the results of a theoretical and experimental

study of the nominal conditions and characteristics of the unit for different ratios between the power of the diesel N_d and excess power of the turbine N_t. It is concluded that additional power boosting of the 16CHN25/27 engine should take the path of a changeover to a diesel-turbine unit with ratio $N_d/N_t = 3.0$. Figures 3; table 1; references 6.

USSR

UDC 621.438-253.5:539.4

INFLUENCE THAT TANGENTIAL INCLINATION OF GUIDE VANES HAS ON THE DYNAMIC STRENGTH OF TWISTED MOVING BLADES IN AN AXIAL TURBINE

TRUDY LENINGRADSKOGO KORABLESTROITEL'NOGO INSTITUTA [Transaction of Leningrad Shipbuilding Institute] in Russian No 101, 1975 pp 71-77

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 10, 1976 Abstract No 10.49.69]

MITYUSHKIN, YU. I., MOISEYEV, A. A., NADELYAYEV, A. V., RUDENKO, A. I., and FILATOV, V. I.

[Text] An investigation was made of two types of turbine stages with cylindrical flow section formed by combining different guide vane assemblies with type $A24B_1$ and $A24B_2$ working wheels. The principal parameters of the investigated stages were: inside diameter of the stationary and moving cascades 300 mm, length of the working blades $Z_1 = Z_2 = 60$ mm, height of the guide vane assemblies at the outlet 58 mm, number of guide vanes 30, number of working blades 62, axial clearance between the stationary and moving cascades 12 mm, radial clearance between a working blade and the housing 0.8 mm. The root sections of both working cascades utilized the same type A24M constant-attack profile: vane chord 25.5 mm, angle of setting 74°50', radius of the inlet edge 1.73 mm, geometric angle of intake 24°42'. The other cross sections of the $A24B_1$ and $A24B_2$ working wheels were obtained by profiling in accordance with conditions of fixed circulation lengthwise of the working blade. Data are given on twisting of the blades in the guide vane assembly with angles of flow outlet on the average radius of 16°40' and 23° respectively. Vibration and aerodynamic studies done on turbine stages with working blades twisted in accordance with a "free vortex" law with relative length $Z/D_{av}=1/6$ and angles of flow outlet from the nozzles α_{1av}= 16 and 23° shows that reduced tangential inclination of guide vanes with concave side toward the turbine axis, which ensures practically constant degree of reactivity lengthwise of the working blade, appreciably reduces the level of dynamic stresses of bending of working blades of variable cross section by aerodynamic forces in the case of resonance vibrations on the fundamental tone. Therefore in cases where a determining factor is the vibration strength of the blading, a moderate tangential inclination can be used on the guide vanes and in the turbine stage with twisted unbanded working blades of variable cross section. Figures 4; references 8.

USSR UDC 533.6.011:62-135

INVESTIGATION OF THE INFLUENCE THAT NONRADIAL ARRANGEMENT OF NOZZLE VANES HAS ON THE AERODYNAMIC AND VIBROACOUSTIC CHARACTERISTICS OF A TURBINE STAGE WITH TWISTED BLADES

TRUDY LENINGRADSKOGO KORABLESTROITEL'NOGO INSTITUTA [Transactions of Leningrad Shipbuilding Institute] in Russian No 101, 1975 pp 57-64

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 10, 1976 Abstract No 10.49.32 by L. P. A.]

MAMAYEV, V. A., MITYUSHKIN, YU. I., and PEREVOZNIKOV, A. V.

[Text] The extensive use of twisted blades in the last stages of marine turbine units, and also comprehensive studies of single-stage turbines with working vanes twisted in accordance with the law $r \cdot c_u = \text{const}$ and tangential inclination of guide vanes with $\alpha_{1av}=16°30'$ have raised the problem of further investigation of the influence that reducing the reactivity gradient lengthwise of the working blade has on aerodynamic characteristics, vibroactivity of the housing and front-end bearing, and also on the level of air noise of aerodynamic origin. Comprehensive aerodynamic and vibroacoustic studies were done on the EVT-2 experimental air turbine. Model stages with moderate fanning were studied (with $\alpha_{1av}=23°$): 30-A24 B_2, 31-A24 B_2, 35-A24 B_2 and 37-A24 B_2 differing only in the guide vane assembly and having the same working wheel (A24 B_2) with unbanded working blades of variable cross section twisted to conform to the condition $r \cdot c_u = \text{const}$. The main parameters of the investigated stages were: inside diameter of the stationary and working cascades $D_{in}=300$ mm, length of a working blade $Z_1=Z_2=60$ mm, height of the nozzle cascade at the outlet $h_1=58$ mm, number of guide vanes $Z_g=30$, number of working blades $Z_w=62$, axial clearance between the stationary and moving cascades 12 mm, radial clearance between the working blades and the housing 0.7 mm. Curves are given for the influence that the intensity of swirling of the flow $\Delta\alpha_1=\alpha_{1k}-\alpha_{1B}$ at the outlet from the guide vane assembly as well as the type of guide vane assembly have on the integral characteristics of a turbine stage with working blades twisted in a free vortex law; the influence that tangential inclination of the guide vanes has on the quantity $\Delta\alpha_1$, the redistribution of work lengthwise of a working blade twisted to conform to the condition $r \cdot c_u = \text{const}$ at different angles $\Delta\alpha_{1av}$ of flow outlet on the average radius. A reduction is noted in the vibration of the bearing housing and the noise level emitted by the housing when guide vane assemblies with low $(\text{grad } P)_r$ are used. Figures 3; references 4.

USSR UDC 62-136:533.6.011

INVESTIGATION OF ANNULAR CASCADES WITH TANGENTIAL INCLINATION OF THE GUIDE VANES

TRUDY LENINGRADSKOGO KORABLESTROITEL'NOGO INSTITUTA [Transactions of Leningrad Shipbuilding Institute] in Russian No 101, 1975 pp 85-91

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 10, 1976 Abstract No 10.49.30 by L.P.A.]

PEREVOZNIKOV, A. V.

[Text] The author studied the flow and determined the structural and integral characteristics behind annular nozzle cascades with tangential inclination of the vanes at an angle of outlet from the nozzles on the middle radius of $\alpha_{1av}=\arcsin O_1/t_1=23°$; on this basis generalizations can be made with the use of available data on forced blow-through of annular cascades with $\alpha_{1av}=16°$ for an analogous range of tangential inclination of the vanes. The investigated annular cascades (30, 31, 35 and 37) in a cylindrical cross section with respect to average diameter had an aerodynamically perfect profile TS-2A with relative pitch $t_{1av}/b_1=0.722$ and angle of setting $\alpha_s=46°15'$. The guide vane assembly is formed of vanes with invariant chorde of $E_1=51.95$ mm and twisting in accordance with the law $rc_s=\text{const}$. Experimental studies of the aerodynamic characteristics of the annular nozzle cascades were done on the SKR-2 air stand by the method of traversing the flow on the outlet at velocities $\lambda cn_{1t}=C^{nc}{}_{1t}/\alpha_{cr}=0.59-0.60$, where $C^{nc}{}_{1t}$ is the theoretical outlet velocity of the gas from the nozzle cascade as determined from the pressure ratio $P_{1E}+P_{1k}/2P_0$, where P_{1E} and P_{1K} are the static pressures at the tip and root respectively of the guide vane as averaged over the pitch at Reynolds numbers $C_1E_1p_1/\mu_1 \approx (5.5-6.0)\cdot 10^5$. The studies were done on a stand with a resistance in the cylindrical flow section of the outlet unit behind the annual cascades partially simulating the influence of a working wheel with untwisted constant-attack working blades. A comparison of the principal characteristics of annular cascades with tangential inclination of the guide vanes (for different angles of inclination δ_{av} with respect to radius and with relative height $Z_1/D_{1av}=1/6$ and 1/7) led to practical recommendations on designing guide vane assemblies for axial turbine stages with reduced gradient of static pressure. Figures 3; references 12.

USSR UDC 621.438.056:533.6

IMPROVING THE EFFICIENCY OF AN ADAPTER PIPE WITH LARGE INSIDE TAPERS

TRUDY LENINGRADSKOGO KORABLESTROITEL'NOGO INSTITUTA [Transactions of Leningrad Shipbuilding Institute] in Russian No 103, 1975 pp 70-73

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 10, 1976 Abstract No 10.49.28]

SHCHEKUN, G. D.

[Text] An investigation is made of the adapter fitting between the high-pressure compressor and combustion chamber of the GTK-40 gas turbine installation. The main design elements and geometric dimensions of the adapter are common to present-day two-stage gas turbine units. These adapters are characterized by large internal taper angles reaching 70° and a relatively short length L=0.2-0.15. The flow section is blocked by braces and connecting lines. The paper gives the results of an experimental study of a model of an intermediate adapter. Principal geometric dimensions of the fitting are: relative length L=L/D=0.18, degree of expansion $h=F_2/F_1=2.4$, internal taper angle $\gamma = 24°$, $\gamma = 72°$. In the modeling the Mach number calculated from the parameters of the inlet section was ≈ 0.21, which is close to the full-scale value. The Reynolds number was calculated for the average diameter of the inlet section, and was $2 \cdot 10^6$. Conventional techniques can be used to account for the influence of the Mach and Reynolds numbers when scaling up to the actual installation. In addition to complete geometric simulation of the adapter construction the aerodynamic study also included modeling of the turning-vane blading of the high-pressure compressor with angle $\alpha_1=81°$, and a set of grids was used to simulate the drag of the combustion chamber registers at the outlet from the adapter.

USSR UDC 621.125.002

INFLUENCE THAT THE APERTURE ANGLE OF THE PERIPHERAL BOUNDING SURFACE HAS ON THE STAGE CHARACTERISTICS FOR DIFFERENT RATIOS OF BLADING FLOW AREAS

TRUDY LENINGRADSKOGO KORABLESTROITEL'NOGO INSTITUTA [Transactions of Leningrad Shipbuilding Institute] in Russian No 101, 1975 pp 132-138

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 10, 1976 Abstract No 10.49.26]

[Text] The paper gives the results of an experimental study of a series of model stages ($D_{av}/l_w=4.12$) with overall conical directivity of the

peripheral bounding surface of the flow section with taper angles θ_v=23 and 29° for different ratios between the flow areas F_2 of the working cascade and F_1 of the guide blading. The ratio F_2/F_1 was varied by changing the angles of setting of the vanes in the guide blading. Turbine stages with cylindrical bounding surfaces were taken as the initial models. It is shown that when a taper is introduced into the flow section of the stages, a concomitant change in F_2/F_1 has a considerable effect on the stage characteristics. Figures 6; references 5.

USSR UDC 621.165

SELECTION OF THE PARAMETERS OF THE TURBINE IN A BRAKING DRIVE BY MEANS OF APPROXIMATING DEPENDENCES

TR. LENINGR. KORABLESTROIT. IN-TA in Russian No 101, 1975 pp 78-84

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 12, 1976 Abstract No 12.49.12]

OVSYANNIKOVA, I. V.

[Text] A turbine braking drive allows investigation of turbine stages and the entire turbine over a broad range of change of modes. Depending on the task of investigation of the turbine model, the braking drive can operate either in the counter gas mode (receiving load corresponding to the power of the turbine being studied) or over a broad range of loads including modes of output of energy of the turbine being studied. The parameters of the turbine of the braking drive operating in the counter gas mode can be selected by a method, the basis of which is to be found in the approximating dependences of the relative internal efficiency and relative power. Using these dependences, one can solve the system of equations presented in this work and select the optimal mode and geometric parameters for the braking drive turbine. Figure 1; table 1; references 5.

USSR UDC 621.224:532.528:620.193

DESIGN METHODS OF REDUCING CAVITATION EROSION OF THE PIPES IN OPERATING HYDROELECTRIC POWER PLANTS

8-y SIMPOZ. MAGI. SEKTS. PO GIDROMASHINAM, OBORUD. I KAVITATSII in Russian 1976, Leningrad 1976 pp 192-207

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 12, 1976 Abstract No 12.49.207 by L.P.A.]

SOTNIKOV, A. A., and PYLAYEV, N. I.

[Text] A study is made of methods of reducing cavitation erosion of hydraulic turbines developed at the Leningrad Machine-building Plant, by changing the shape of the inlet edge of the blade, installation of separating ribs, and feeding of air into the cavitation zone. A test of the effectiveness of the measures was undertaken both under laboratory and under field conditions at operating hydroelectric power plants: the Verkhne-Tulomskaya, Bratsk and Krasnoyarsk Power Plants. The change in configuration of the input edge of the turbine blades at the Verkhne-Tulomskaya plant led to a significant reduction in the rate of cavitation erosion: the volume of metal lost was decreased by a factor of approximately 15. The installation of separating ribs at the Krasnoyarsk Power Plant led to a decrease in cavitation erosion; the volume of metal damaged on blades with ribs was decreased by a factor of 10-15. It was found that the form of the rib has no significant influence on the intensity of erosion; with increasing rib height, erosion intensity decreases. Test stand studies were used to check the effectiveness of feeding air into the cavitation zone. Tests with cavitation on aluminum plates showed that the depth of deformation in the main zone located near the intake edge decreases with air inlet by a factor of 30 times in the mode which produces 240 Mw, and by 80 times in the mode which produces 200 Mw. At the present time, turbines of the Bratsk Power Plant are being equipped with air feed systems. Figures 4; references 3.

USSR UDC 629.7.036.3.001.2

COMBINED METHODS OF CALCULATION OF HIGH VELOCITY CHARACTERISTICS OF GAS TURBINE ENGINES

[TR.] MOSK. AVIATS. IN-TA in Russian 1976 No 356, pp 29-38

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 12, 1976 Abstract No 12.34.75 from the resume]

BARYSHOV, N. D., BRUK, A. A., and DULEPOV, N. P.

[Text] The essence of the combined method consists in the fact that determination of the working points of low and high pressure stages, i.e.,

the most cumbersome portion of the calculation involved in correlation of the operation of the turbine and compressor is performed by equations expressed through gas dynamic functions. Calculation of the intake, outlet and combustion chamber sections, where there are no or significantly less iterational correlations of parameters, is performed by means of thermodynamic functions. This means that in the sectors of operation of the compressors and turbines, average values of heat capacities and adiabatic indices are used, while in the sectors of operation of the combustion chamber, intake and outlet devices, variable heat capacities are used. As a calculation plan, a turbine with a common fan and separate air circuits is used. Figures 4; references 2.

USSR UDC 624.7.036.3:533.6

CALCULATION OF THE CHARACTERISTICS OF A MULTISTAGE AIRCRAFT TURBINE

SB. NAUCH. TR. PERM. POLITEKHN. IN-T in Russian No 167, 1975 pp 138-141

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 12, 1976 Abstract No 12.34.30 from the resume]

RONZIN, V. D., and CHEREMISIN, P. M.

[Text] The accuracy of calculation of the characteristics of gas turbines can be significantly increased by considering the variability of heat capacity in the process of gas expansion. In the range of operating modes of aviation gas turbines, the heat capacity depends primarily on gas temperature and excess air factor. Since a change in gas temperature before the turbine involves a change in excess air factor, the heat capacity on gas temperature alone can be determined. With a gas temperature drop in each stage of the turbine of not over 200 C, the variability of heat capacity and adiabatic index of expansion of the gas can be most conveniently considered by using in the calculation the values of adiabatic index K_{exp}=const corresponding to the mean gas temperature in the stages. Figures 3; references 2.

USSR UDC 621.165:534-19

INVESTIGATION OF THE VIBRATION RELIABILITY OF THE KHAR'KOV TURBOGENERATOR PLANT K-500-240-2 TURBOAPPARATUS

TRUDY VSESOYUZNOGO TEPLOTEKHNICHESKOGO NII. URAL'SKIY FILIAL [Works of the All-Union Heat Engineering Scientific Research Institute] in Russian No 12, 1976 pp 106-109

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 8, 1976 Abstract No 8.49.65 by L.P.A.]

KOVAL', G. S., GUSIKHIN, YU. P., SHKOL'NIK, G. T., KORABLEV, V. I., MAKHORTOV, V. P., and NABOKA, V. G.

[Text] The results of vibration investigations carried out in recent years on 300- and 500-MW turboapparatus have found reflection in the design of the new series of 500-MW turboapparatus. The main problems of the investigation were the evaluation of effectiveness of the structural specifications and the vibration reliability of the turboapparatus as a whole, as well as the production of experimental data necessary for future refinement of computing the vibration characteristics of the dynamic system drive shaft--bearings--base at the planning stage. For this purpose equipment was manufactured to determine the dynamic compliance of the base and the support in a broad range of frequencies and amplitudes of the dynamic loads; a new procedure was developed for investigating vibrations of the drive shaft which uses a multichannel apparatus operating in an assembly with small inductive counters. The authors cite data on correcting the plant operating instructions. Holding time for heating the turbine during turning should be 1000 and 2200 min^{-1}. The zone of rotation frequency of 1200-2000^{-1} must be passed through rapidly without stopping.

USSR UDC 536.21:621.165

INVESTIGATION OF THE NONSTATIONARY HEAT STATE OF THE COMPONENT PARTS OF STEAM TURBINES OF FLANGE-PIN TYPE

PROBLEMY MASHINOSTROYENIYA. RESPUBLIKANSKIY MEZHVEDOMSTVENNIY SBORNIK [Problems of Machine Construction. Republic Interdepartmental Collection] in Russian No 2, 1976 pp 106-112]

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 8, 1976 Abstract No 8.49.50]

PEREVERZEV, D. A., and LEBEDEV, A. G.

[Text] The authors investigate a flange connection of the inner case of a high-pressure cylinder of a turboassembly type K-500-240 under startup

conditions from the uncooled state. They show how filling the gap between the flange and the pin with a high heat-conducting material influences the heat state of the flange connection. They give recommendations for selecting the applicable regime of heating and loading for limiting the thermal stresses arising on the flange connection in regimes of accelerated startup. Figures 4; tables 2; references 5.

USSR UDC 533.6.011

NUMERICAL SOLUTION TO THE CHAPLYGIN EQUATION RELATIVE TO LAVAL NOZZLE THEORY

Frunze DVUMERNOYE I TREKHMERNOYE TECHENIYE ZHIDKOSTI I GAZA [Two-Dimensional and Three-Dimensional Flow of Liquid and Gas, Collection of Works] in Russian, Izd-vo Ilim, 1975 pp 17-31

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 8, 1976 Abstract No 8.49.18]

BIYBOSUNOV, I., and MAMBETKULOV, ZH.

[Text] The authors examine the plane-parallel near-sonic flow of gas in a shockless Laval nozzle. Here the quasilinear Chaplygin equation, written relative to the angle of slope $u(\sigma,\psi)$ with the corresponding nonlinear boundary condition, is linearized using the method of expansions. The authors propose a procedure for solving a linear differential equation in partial derivatives of the second order in first approximation by numerical methods. Figure 1; references 7.

USSR UDC 533.697

INVESTIGATION OF FLAT COMPRESSOR GRIDS IN A CLOSED WIND TUNNEL

Ufa ISPYTANIYA AVIATSIONNYKH DVIGATELEY [Aviation Engine Tests, Collection of Works] in Russian No 3, 1975 pp 188-189

YEVTEYEV, I. V., MITROFANOV, A. A., and SOLOKHINA, YE. V.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10, 1976 Abstract No 10B1228 by the authors]

[Text] The authors cite several results of an experimental investigation of flat compressor grids in a closed wind tunnel of variable density. They obtain generalized data for creation of an approximate method of computing losses during reduced values of the Reynolds criterion. References 11.

USSR UDC 531.768

AN ACCELEROMETER

OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNARKI in Russian No 42, 1976 p 104 Item No 535513

MEL'NIKOV, V. YE., OBUKHOV, V. I., KLIMKIN, I. S., POPOV, N. V., and SHOSHIN, A. A., Moscow Order of Lenin Aviation Institute imeni Sergo Ordzhonikidze

[Text] An acceleromter containing a body filled with a liquid, an elastic hollow cantilever containing a rod made of fused quartz, an inertial mass and a jet sensor, is distinguished by the fact that to decrease the dimensions and increase accuracy, the elastic cantilever and inertial mass are made in the form of a stepped flask, within which the jet sensor is located parallel to the generatrix of the rod.

USSR UDC 621-555.6

A SYSTEM FOR REGULATION OF THE GAS TEMPERATURE IN THE PRECHAMBER OF A WIND TUNNEL

OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 42, 1976 p 112 Item No 535555

KLYATSKIN, S. V., KHARLAKHINA, O. S., and GEL'MAN, G. A.

[Text] A system for regulation of the gas temperature in the prechamber of a wind tunnel, containing a gas temperature sensor installed at the inlet to a pipe and connected through a comparison unit, connected to a programmer, to an actuating element, is distinguished by the fact that to increase the accuracy of regulation, the device includes an additional gas temperature sensor installed at the output of the prechamber and comparison unit, differentiator, detector, relays, switch and memory unit, the additional gas temperature sensor being connected to the first additional comparison unit, connected to the programmer, the output of which is connected through the series connected differentiator, detector and second additional comparison unit to the relay, through the contacts of the relay to the series connected switch and memory unit, the output of which is connected to the comparison unit.

USSR UDC 629.78.064.3

CALCULATION AND DESIGN OF A BRANCHED RESONATOR AS A DAMPER OF PULSATIONS OF THE WORKING MEDIUM IN PIPELINE SYSTEMS

[NAUCH. TR.] KUYBYSHEV, AVIATS. IN-T in Russian No 2(73), 1975 pp 141-151

SHORIN, V. P., and SANCHUGOV, V. I.

[From REFERATIVNYY ZHURNAL 41 RAKETOSTROYENIYE No 10, 1976 Abstract No 10.41.144 Resume]

[Text] Presented is a method of calculating a branched resonator for determining the efficiency of damping pulsations when a resonator is installed in an arbitrary hydraulic system. The efficiency of resonator action is estimated by the coefficient of damping introduced. The resonator is regarded as an element with concentrated parameters. The method of design calculation helps in determining the main geometric parameters of a minimum-volume resonator ensuring a pulsation smoothing effect not less than the value given in the required frequency range. Calculated and experimental functions of the coefficient of damping introduced are presented, dependent on the frequency and level of initial amplitude of the pressure pulsations beyond the source. Figures 4; references 3.

USSR UDC 629.78.018.1

EFFECT OF POSITION OF CLOSING SYSTEM OF COMPRESSION WAVES IN A DIFFUSOR ON THE PRESSURE RECOVERY FACTOR IN A HYPERSONIC WIND TUNNEL

UCH. ZAP. TSENTR. AERO-GIDRODINAMI. IN-TA in Russian Vol 7, 1976 No 2, pp 58-66

[From REFERATIVNYY ZHURNAL 41 RAKETOSTROYENIYE No 10, 1976 Abstract No 10.41.113 Resume]

KONOTOP, V. A., and TIKHOMIROV, YU. A.

[Text] An experimental study was made of pressure distribution along the line of a hypersonic wind tunnel with two diffusor variants; the variants differ in throat size ($\overline{F}_t$ = 1.0 and 1.7 [t = throat]). Throat and model size in the working section is shown to influence the limiting position of the closing system of compression waves. An explanation is given for earlier data according to which, during tests of model insertion, the diffusor with the larger throat permits higher values of the pressure recovery factor to be derived.

USSR UDC 534

INFLUENCE OF RESISTANCE OF A MEDIUM ON SMALL OSCILLATIONS OF A MATHEMATICAL n-PENDULUM WITH A MOVING SUSPENSION

Kuybyshev MEKHANIKA [Mechanics, Collection of Works] in Russian, No 9, 1975 pp 58-62

KUZNETSOV, V. P. and KOZYREVA, YE. K.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9A95 by the authors]

[Text] The authors investigate the oscillations of a mathematical n-pendulum near the lower position of equilibrium under the influence of a nonlinear one-arm resistance of a medium moving along with the suspension of the pendulum. Using the Krylov-Bogolyubov method in first approximation they establish the character of the movement in the zone of instability of the linear system with vertical vibrations of the suspension and give an analysis of the influence of the horizontal component of the suspension vibrations.

USSR UDC 531

QUASIPRECESSION MOVEMENTS OF AN ELASTIC BODY

Leningrad TRUDY LENINGRADSKOGO INSTITUTA AVIATSIONNOGO PRIBOROSTROYENIYA [Works of the Leningrad Institute of Aviation Instrument Construction] in Russian, No 97 pp 30-33

GROBOV, V. A.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9A40 by the author]

[Text] The author investigates the quasiprecession movements of an elastic body caused by energy transfer of elastic oscillations into rotational movement of the body around the center of mass. He shows that as a result of the mutual influence of the elastic oscillations and the rotational movements of the body around the center of mass the velocity of the natural rotation and amplitudes of the transverse components of the angular velocity of the body vary slowly in time. References 5.

USSR UDC 531

SYNTHESIS OF A SYSTEM FOR STABILIZING A GYROSTABILIZED PLATFORM WHEN THE MUTUAL DISPOSITION OF THE GYROSCOPES ON THE PLATFORM IS NONORTHOGONAL

Saratov NAUCHNYYE TRUDY SARATOVSKOGO POLITEKHNICHESKOGO INSTITUTA [Scientific Works of Saratov Polytechnic Institute] in Russian No 93, 1975 pp 75-90

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9, 1976 Abstract No 9A48 by the author]

ALEKSANDROV, A. G.

[Text] The feature of the examined gyrostabilized platform is the mutually nonorthogonal disposition of gyroscopes on the platform, which causes a substantial interfluence of the channels. The author introduces the concept of frequency indicators of quality. He formulates the problem of synthesis. He finds the solution, based on the construction of a special variation problem, the solution to which is accomplished on the basis of the Lyapunov-Bellman method. He cites the results of the numerical solution to the specific problem of synthesis. References 8.

USSR UDC 621.313.392

A HYSTERESIS ELECTRIC DRIVE FOR A GYROSCOPE ROTOR

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 40, 30 Oct 76 p 149 Author's Certificate No 534015 filed 31 Jul 72

DELEKTORSKIY, B. A., and TARASOV, V. N., Moscow "Order of Lenin" Power Engineering Institute

[Text] This Author's Certificate introduces a hysteresis electric drive for a gyroscope rotor. The drive contains a hysteresis electric motor, and a generator of pulses that overdrive the motor with a synchronization circuit. As a distinguishing feature of the patent the characteristics of the electric motor are stabilized with simultaneous reduction of power consumption by adding a frequency divider for the power supply of the electric motor to the synchronization circuit of the generator of overdriving pulses.

USSR UDC 662.61:662.66:621.181.7

MASTERING THE VORTEX METHOD OF BURNING BITUMINOUS COALS IN A STEAM GENERATOR WITH SOLID SLAG REMOVAL

TRUDY ALTAYSKOGO POLITEKHNICHESKOGO INSTITUTA [Works of the Altay Polytechnic Institute] in Russian No 48, 1975 pp 61-63

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 10, 1976 Abstract No 10R11 by S. G. Dupleva]

DUL'NEVA, L. T., SHESTAKOV, S. M., CHERNYSHEV, A. A., and SERGEYEV, V. N.

[Text] To increase the slag-free thickness for the vortex buring method the authors used a boiler of TP-230-2 type of No 2 steel from the Pervomaysk Thermoelectric Power Plant of the Leningrad Energy Combine with a productivity of 230 T.hour and steam parameters of 510°C and 100 kGauss/cm^2. The boiler was equipped with four 1660/2004 grinding mills having batch separators and direct-flow gas flame burners with built-in upper secondary air. The series of tests in the period of 1970 to 1975 showed that the basic premises used in the reconstruction project were found to be efficient. The boiler carries the load stably up to 250 T/hour, slagging of the burners and convective sections is completely eliminated. But reduction of the gas temperature behind the furnace by 80-100°C after conversion of the boiler to the vortex burning method led to a reduction in temperature of the heated steam below the nominal. On the basis of the results of the tests the conclusion was made that the passage of unburned particles of fuel to the interembrasure space exerts no decisive influence on the loss of heat with mechanical underheating. From sieve analysis of the dust samples it is clear that in the direct-flow part of the jet the number of particles of 80-200 micrometers is high, which contribute a significant amount to the mechanical underheating. Gas analysis along the length of the jet showed that the front zone must be loaded with fuel which can be achieved by coarsening of the milling and installing deflector separators in the burners. Figure 1; references 1.

USSR UDC 621.835

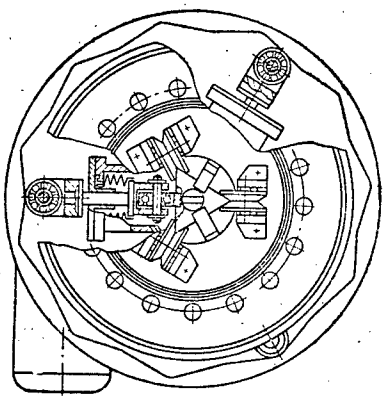
A DEVICE FOR TRANSMITTING TRANSLATIONAL MOTION INTO A VACUUM

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 40, 30 Oct 76 p 101 Author's Certificate No 533782 filed 20 Mar 74

DANILOV, K. D., and NAZAROV, L. N.

[Text] This Author's Certificate introduces a device for transmitting translational motion into a vacuum. The unit contains a hermetically

sealed housing that carries a driving link, a driven link made in the form of a rack, and hermetically sealed push rods that interact at one end with the driving link and at the other end with the rack. As a distinguishing feature of the patent, the design increases the speed of translational motion of the driven link in vacuum and ensures uniform motion. The rack is made in the form of a prism with lateral surfaces that have tooth-shaped sections. Each of these sections has displacement in the direction of the longitudinal axis of the rack relative to the adjacent section, and is made up of nonworking parts (rounded peaks and valleys) and straight-line working parts that connect the peaks and valleys. The ends of the push rods are fitted with rollers and the driving link takes the form of a wheel with the inside profile analogous to the profile of the sections of the lateral surfaces of the rack.



USSR UDC 621.438

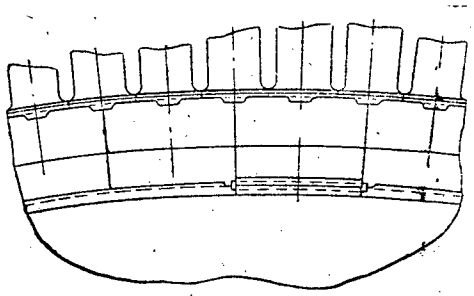
A DEVICE FOR CLAMPING BLADES IN THE DISK OF A TURBOMACHINE

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 40, 30 Oct 76 p 90 Author's Certificate No 533738 filed 29 Apr 74

KRIVOSHEY, V. YA.

[Text] This Author's Certificate introduces: 1. A device for clamping blades in the disk of a turbomachine, chiefly for turbines. Sectoral shim plates are placed around the periphery in recesses of the blade flanges and the rim of the disk. Axial motion of the plates is prevented by a wire. As a distinguishing feature of the patent, assembly and disassembly are simplified by making an elevated projection on the rim where the lockplate is located. The outside diameter of this projection is equal to the

diameter of the recess in the rim, and the wire is held in an opening formed by grooves made in the lockplate and in the projection. 2. A modification of this clamping device with the distinguishing feature that the opening and the wire are rectangular in cross section.



USSR UDC 621.181.004.2(47+57)

ON THE OPERATION OF A TYPE TPP-200-1 BOILER AT THE SLAVYANSK STATE REGIONAL ELECTRIC POWER PLANT WITH COMBINED BURNING OF ANTHRACITE DUST AND BLACK OIL

ENERGETIKA I ELEKTRIFIKATSIYA. NAUCHNYY-PROIZVODITEL'NYY SBORNIK [Power Engineering and Electrification. Scientific-Production Collection] in Russian No 3(87), 1976 pp 19-20

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 10, 1976 Abstract No 10R61 by A. V. Rybakin]

KOSHELEV, P. M.

[Text] In the reconstruction of the boiler aggregate TPP-200-1 (2650 T/hour, 255/37 kGauss/cm^2, 545/545°C) 8 black oil dust burners were installed with black oil nozzles TKZ-6 with a productivity of 8 T/hour each. For effective burning of the black oil, a supply of primary air (rate of 44 m/sec) is fed to the central channel of the burner; the basic amount of air moves in a direct flow, and only 20% of the flow, next to the nozzle, is twisted by a blade vortexer. During operation of the burners on anthracite dust a small current of air arrives through the central channel. The following regime of furnace operation was established: simultaneous burning of the two types of fuel in one burner device is not allowed; a combination of the burners is set up in such a way that along with the burner operating on black oil a burner operates on dust, and opposite the black oil burner the dust burner operates; to ensure a constant slag film the combination of operating burners must be changed once every 8 hours (burners operating on black oil are converted to dust,

and those operating on dust -- to black oil). The results of the heat tests are given. The gross efficiency of the boiler aggregate is 90.5%. The plan used for simultaneous burning of liquid and solid fuel may be recommended for future implementation in boilers with liquid slag devices.

USSR UDC 536.24

A DEVICE FOR INVESTIGATING HIGH-TEMPERATURE HEAT PROTECTION

Novosibirsk VSESOYUZNYY SIMPOZIUM PO METODAM AEROFIZICHESKIKH ISSLEDOVANII [All-Union Symposium on Methods of Aerophysical Investigations, Collection of Works] in Russian, Text of Reports, 26-29 Apr 76 p 44

KISELEV, G. A., KUTS, S. M. and TRUBITSYN, A. I.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B451 from the texts]

[Text] The authors describe a device for luminous heating TBK-301 and the results of an investigation of the thermophysical properties of high-temperature heat-protection screens. The TBK-301 device is designed for modeling the thermal regime of structural elements and heat protection of a broad range of aircraft according to the surface density of the thermal flux up to $0.6 \cdot 10^6$ W/m^2 under conditions of variable pressure from 0.2 mn/m^2 to about $1 \cdot 10^{-3}$ n/m^2. The device is equipped with a system of programmed automatic control of temperature, which permits reproducing the temperature regime of the elements of the aerodynamic surface of the aircraft and also to investigate the thermophysical properties of the heat protection using quasi-stationary methods. An investigation was made on the device for the thermal conductivity of multilayer heat protection screens in a vacuum of about $1 \cdot 10^{-3}$ n/m^2 as well as in an atmosphere of air and inert low-heat-conducting gas (xenon) at a temperature of the outer surface of about 1600°K.

USSR UDC 533.652/.661.013

METHOD OF MEASURING THE AERODYNAMIC CHARACTERISTICS OF MODELS OF AIRCRAFT WITH A CHANNEL OF AIR IN WIND TUNNELS WITH HEATING OF THE STREAM

Novosibirsk VSESOYUZNYY SIMPOZIUM PO METODAM AEROFIZICHESKIKH ISSLEDOVANII [All-Union Symposium on Methods of Aerophysical Investigations, Collection of Works] in Russian, Texts of Reports, 26-29 Apr 76 p 100

ALEKSANDROVICH, YE. V.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B1001 from the texts]

[Text] The author gives the results of developing a method of measuring the aerodynamic characteristics (resistance C_x, lifting force C_y, longitudinal moment m_z, aerodynamic quality K) of models of aircraft with a channel of air in wind tunnels with heating of

the stream ($M \geq 6$). He develops the basic principles of planning the models, measuring the necessary aerometric parameters and selects the types of measuring instruments (in particular types of thermocouples) to obtain the maximum measurement accuracy C_x in. To decrease the influence of reduction of the temperature of slowdown of the air along the channel the author proposes making the channels of the model from heat insulating materials.

USSR UDC 532.57+532.137+536.51+532.14.08+531.787

INVESTIGATION OF SHORT-TERM FLOWS OF IONIZED GAS USING PROBE METHODS

Novosibirsk VSESOYUZNYY SIMPOZIUM PO METODAM AEROFIZICHESKIKH ISSLEDOVANII [All-Union Symposium on Methods of Aerophysical Investigations, Collection of Works] in Russian, Texts of Reports, 26-29 Apr 76 pp 54-55

GLADYSHEV, M. K., GORELOV, V. A., KIL'DYUSHOVA, L. A. and KOROLEV, A. S.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B1197 from the texts]

[Text] The authors examine the question of using probes of cylindrical, conical and acicular shape for diagnosing short-term flows relative to the dense ionized gas behind the front of a strong shock wave in an electric discharge shock pipe (velocity of the shock wave V_s = 4-11 km/sec, air, P_0 = 0.1-2.0 mm Hg) and in a hypersonic pulse pipe (M_∞ = 10-18). In the latter case the authors investigated the region of ionization during flow around bodies of different shape (sphere, cone). They examine the method of probe measurements in streams containing an impurity of particles in the solid and liquid phase. They give examples of probe measurements behind the shock wave in a mixture of air with vapors of H_2O, C_2H_5OH, CCl_4 and during hypersonic flow around bodies with jet injection of water.

USSR UDC 629.761.78.015:533.6

INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF ROTATING AXISYMMETRICAL BODIES

Novosibirsk VSESOYUZNYY SIMPOZIUM PO METODAM AEROFIZICHESKIKH ISSLEDOVANII [All-Union Symposium on Methods of Aerophysical Investigations, Collection of Works] in Russian, Texts of Reports, 26-29 Apr 76 p 97

BYCHKOV, N. M. and KOVALENKO, V. M.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B1007 from the texts]

[Text] The Institute of Theoretical and Applied Mechanics (Siberian Department, Academy of Sciences USSR) has developed an experimental setup and method of measurement which permit determining the transverse forces (lateral and normal) and also the moments of these forces on rotating and nonrotating models of different configuration (finned and unfinned with expansion up to $\lambda = 40$) for subsonic and supersonic stream velocities. The setup makes it possible to make measurements at a constant (but regular in the range up to $n = 10^4$ rpm) velocity of rotation of the model with practically zero influence of the drive on the readings of the two-component strain scales. Experimental investigations of the transverse forces were made in wind tunnels T-313 of the Institute ($M_\infty = 2-4$, $\alpha = 0°-15°$, $\lambda = 40$) and the T-324 ($U_\infty = 10-80$ m/sec, $\alpha = 0°-90°$, $\lambda = 18-40$). The obtained results refer to the field of measurements of the basic parameters investigated earlier and may be used in computing the trajectory of rotating rockets and missiles.

USSR UDC 536.2:621.375.826.082

A DEVICE FOR THERMAL CYCLING TESTING OF TURBINE BLADES

OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 42, 1976 p 113 Item No 535556

ANDRIANOV, YU. V., KANTSEPOL'SKIY, A. A., KRAVETS, A. M., and PLATONOV, A. A.

[Text] A device for thermal cycling testing of turbine blades, containing a cooling mechanism connected to a pneumatic cylinder, the piston of which is connected to a hollow shaft, on which are attached a stop and clamp for attachment of a blade placed coaxially with a furnace to which a temperature

sensor is attached, connected to a regulator, series connected to a unit for movement of the blade along the axis of the furnace and a terminal switch, is distinguished by the fact that to increase the speed of operation of the device, it includes a value for a coolant, a standard light source, photographic camera and program controller, one output of which is connected to the shutter of the camera, the other output being connected to the valve for the coolant, while the input is connected to the standard light source and terminal switch.

USSR UDC 621.3.082.5-531

PHOTOELECTRONIC POSITION SENSOR

Moscow OPTIKO MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 10, Oct 76 pp 38-40 manuscript received 10 Feb 76

KLIMASHIN, V. P., SEBKO, S. YE., and MATVEYEV, I. N.

[Abstract] Primary attention is given to a specific realization of a photoelectronic position sensor using modern electronic devices. The output signal of the device is proportional to the displacement of the source of radiation. The sensor consists of a light-sensing head and an electronic circuit for processing of the signal received at subcarrier frequency. The electronic circuitry is made on a printed circuit plate of glass-reinforced textolite measuring 220x180 mm and 1.5 mm thick. References 4.

USSR UDC 531.717.55

AN INDUCTIVE DISPLACEMENT SENSOR

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 39, 25 Oct 76 p 93 Author's Certificate No 532751 filed 9 Sep 74

GAVRILOV, A. N., IZMAYLOV, YE. A., and SMUROV, YU. V., Moscow "Order of Lenin" Aviation Institute imeni Sergo Ordzhonikidze

[Text] This Author's Certificate introduces an inductive displacement sensor that contains a stator, an armature, a load resistor, a supply transformer and working windings connected in a bridge circuit with the secondary of the transformer. As a distinguishing feature of the sensor,

its precision is improved by adding magnetizing windings, a controllable nonlinear element and a diode rectifier bridge. The magnetizing windings are connected to the output of the diode rectifier bridge, and the controllable nonlinear element is connected between the transformer secondary and the diode rectifier bridge.

USSR UDC 550.834

A QUANTUM MAGNETOMETER WITH OPTICAL ORIENTATION OF METASTABLE HELIUM ATOMS

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 39, 25 Oct 76 p 107 Author's Certificate No 532831 filed 4 Jul 75

BLINOV, YE. V., VLASENKO, L. S., ZHITNIKOV, R. A., and SEVAST'YANOV, B. N., "Order of Lenin" Physicotechnical Institute imeni A. F. Ioffe

[Text] This Author's Certificate introduces a quantum magnetometer with optical orientation of metastable helium atoms. The device contains a spectral pumping lamp, a circular polarizer, absorption chamber and photocell all located on the same optical axis. The discharge in the absorption chamber and spectral pumping lamp is excited by high-frequency oscillators. Surrounding the absorption chamber is a radio-frequency coil to which a radio-frequency oscillator is connected. The device also includes a system for automatic tuning of the radio-frequency oscillator and a frequency-measuring system. As a distinguishing feature of the patent, the sensitivity of the magnetometer is improved and requirements for stability of the pumping light source are made less restrictive by surrounding the absorption chamber with a reflector with dielectric coating that transmits radiation corresponding to the wavelength of the pumping light, and by making the photocell sensitive to the radiation of the absorption chamber only in the visible and ultraviolet regions of the spectrum.

USSR UDC 539.4:621.59

METHOD OF STUDYING THE CYCLIC STRENGTH OF MICROBELLOWS AT LOW TEMPERATURES

Kiev PROBLEMY PROCHNOSTI in Russian No 10, 1976 pp 109-113 manuscript received 28 Oct 75

PETRENKO, A. I., ALEKSYUK, M. M., KUZEMA, YU. A., MUZYKA, N. R., and SAMGIN, V. A.

[Abstract] A description is given of a gyrostat and method developed at the Institute of Strength Problems, Academy of Sciences Ukrainian SSR, Kiev,

for testing the cyclic strength of microbellows. Those tested had eight convolutions, inside radius R_v = 0.58 mm, outside radius R_n = 1.25 mm, wall thickness h = 0.02 mm, and were subjected to cyclic loading at up to 100 cycles/min. Expressions are given for determining the relationship between the load and displacement, and formulas are derived for determining the stress condition of a microbellows on the basis of the axial displacement measured during testing. These, plus experimental data on the time to failure under cyclic loading, are the basis for a reliable determination of the stress condition and servicability of microbellows at cryogenic temperatures. Ill 2; biblio 7.

USSR UDC 550.830

A DEVICE FOR MEASUREMENT OF THE ABSOLUTE VALUE OF ACCELERATION OF THE FORCE OF GRAVITY

OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 42, 1976 p 108 Item No 535533

SMELYANSKIY, YU. L., and SHURUBKIN, V. D.

[Text] A device for measurement of the absolute value of the acceleration of the force of gravity, containing a catapult, a falling body with a reflector, an interferometric system, a photoreceptor, amplifier, two threshold elements, coincidence circuits controlled by a flip-flop connected to the switching circuits of the path-time recording circuit, with a standard frequency system generator connected to the time recording system, is distinguished by the fact that to increase the accuracy of measurements, between the amplifier and coincidence circuits is a device for synchronizing the moment of connection and disconnection of the path-time recording system with the zero phase of the path signal, consisting of a zero path signal phase shaper and resonant filters connected parallel to it and adjusted to the frequency of the beginning and end of counting of the path, the outputs of the filter being connected through the zero signal phase shaper to the coincidence circuits.

USSR UDC 532.526

EXPERIMENTAL INSTALLATION FOR THE STUDY OF HEAT TRANSFER OF TWISTED SEMILIMITED JETS IN A CONICAL PIPE

TR. LENINGR. KORABLESTROIT. IN-TA in Russian No 101, 1975 pp 147-155

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B169 by the author]

SUDAREV, A. V.

[Text] A description is presented of the design of a test stand, method of measurements and processing of experimental data for experimental investigation of the aerodynamics and local heat transfer of a circular turbulent twisted jet of air propagating through the internal surface of a cone. Experiments on the installation were performed with twisting angles of 24°, 31°, 45°, 66° and 74°. Each vortexer was tested together with one of three cones (half aperture angle 15°, 45° and 60°). With an unchanged twisting angle, the relative area of the vortexer sleeve varied between 0.25 and 0.72. The vortexers were made in the form of circular grids with straight blades, as is done in the designs of the frontal portions of gas turbine combustion chambers. References 5.

USSR UDC 532.516

WORKING CHARACTERISTICS OF FRICTION BEARINGS WITH TURBULENCE IN THE LUBRICANT LAYER

PRIMENENIYE KONTAKT. GIDRODINAMIKI K ISSLED. DETALEY MASHIN. VYP 3 in Russian Kuybyshev 1976 pp 10-20

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B85 by A. I. Golubev]

SLOBODKIN, V. A.

[Text] Results are described from an experimental study of a bearing in the laminar and turbulent lubricant movement modes. The diameter of the bearing shaft was 50 mm. The bearing was made of 0F10-1 bronze. Tests were performed with diametric clearances of 0.15, 0.27 and 0.35 mm, specific loads of 2-20 mn/m^2, shaft rotating frequency 1200-1600 rpm. The lubricant, fed in at a pressure of 1-4 mn/m^2, was type 22 turbine and type 12 industrial oil. During the experiments capacitance sensors installed on the journal measured the thickness of the layer of lubricant in the bearing. The

distribution of lubricant pressure was determined by piezometric sensors. The temperature at the bearing lubricant inlet and outlet, consumption of lubricant, load on the bearing and moment of friction were also measured. The experimental data produced were processed in the form of dimensionless exponential dependences of load factor, coefficient of friction and Euler criterion for lubricant feed on Reynold's number and shaft eccentricity. The graphs presented show a transition from laminar lubricant flow to turbulent flow at Reynolds numbers near the critical number according to Taylor. An increase is noted in the load bearing capacity and moment of friction upon transition from the laminar mode to the turbulent mode. References 7.

USSR UDC 539.1.074.3

SCINTILLATION DOSIMETERS DRG3-02 AND DRG3-03

IZOTOPY V SSSR in Russian No 46, Moscow Atomizdat Press, 1976 pp 36-37

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 12, 1976 Abstract No 12.32.1676 by P.N.A.]

UNSIGNED

[Text] Dosimeters are designed to measure the dose power of x and γ radiation. The basic technical data are: range of measurement of power of exposure dose of x and γ radiation: DRG3-03 -- 0.01-0.1; 0.3; 1; 3; 10; 30; 100 μR/s. DRG3-02--0.1-1; 3; 30; 100; 300; 1000 μR/s. Primary measurement error: in subranges 0.1 and 0.3 μR/s$\pm$15%, in all other subranges $\pm$10%. Measurement time: in subrange 0.1 μR/s -- 3$\pm$1 s, in all other subranges -- 1$\pm$0.5 s. Power supply voltage 220 V (50 Hz). Time of continuous operation on internal power supplied by RTs-85U elements -- 250 hr. Permissible ambient temperature -10 to +40 C. Dimensions and weight: control panel 220x160x95 mm; 1.9 kg; detection unit 50x330 mm; 1.3 kg. Figure 1.

USSR UDC 621.317.733.025

A TRANSFORMER BRIDGE-COMPARATOR FOR PRECISE MEASUREMENTS OF THE PARAMETERS OF HIGH-OHMIC RESISTORS IN ALTERNATING CURRENT

TR. METROL. IN-TOV SSSR. VNII METROL. in Russian No 154(214), 1976 pp 25-33

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 12, 1976 Abstract No 12.32.1362]

KLEBANOV, I. YA.

[Text] A theoretical and experimental study is presented of an experimental model of transformer bridge-comparator, intended for measurement of the parameters of high-ohmic resistors ($R \geq 10^4$ ohm) in the frequency range $f=400-2\cdot10^4$ Hz with errors less than $5\cdot10^{-3}$%. The accuracy of measurement of residual parameters is increased by approximately an order of magnitude. Figures 5; Table 1; References 11.

USSR UDC 541.18.043.5

LIQUID HIGH ACCURACY SEDIMENTOMETER

PROM. I SAN. OCHISTKA RAZOV, NAUCH.-TEKHN. REF. SB. in Russian No 4, 1976 p 48

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 12, 1976 Abstract No 12.32.1195 by V.L.M.-B.]

PAVLOVSKIY, YE. I. (Editor)

[Text] A diagram and description are presented of the design of a liquid sedimentometer developed at the Semibratovskiy Affiliate of NIIOgaz Institute, intended for determination of the dispersed composition of dusts and powders. The sedimentation capacity is a cylinder immersed in a cup with a dispersed liquid. The cup for collection of the sediment is placed directly beneath the cylinder. The optical system used to record the sediment is placed on the bottom of the cup. In order to record the process of accumulation of sediment, an electronic automatic balanced bridge type EMP-209 is used in the cup. Figure 1.

USSR UDC 536.521.082.52:621.383.45

STUDY OF THE POSSIBILITY OF USING THE EFFECT OF DAMPING OF PHOTOCONDUCTIVITY TO CREATE SENSORS FOR CONTACTLESS MEASUREMENT OF TEMPERATURES IN AUTOMATED CONTROL SYSTEMS

AVTOMATIZIR. SISTEMY UPR. I PRIBORY AVTOMATIKI. RESP. MEZHVED. TEMAT. NAUCH.-TEKHN. SB. in Russian No 38, 1976 pp 133-136

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 12, 1976 Abstract No 12.32.1027]

TOLOKONNIKOV, L. A.

[Text] Results are presented from experimental studies of the effect of damping of photoconductivity of type FSK-2 cadmium sulfide photoresistors with varying intensity of white illumination. It is established that the sensitivity of the method of recording of IR radiation with the FSK-2 photoreceptor depends on the intensity of white illumination. A study is made of the problem of evaluating the use of the FSK-2 photoresistor as an IR radiation receiver in comparison to the FSA-1 photoreceiver currently used in industry. Figure 1.

USSR UDC 536.53:53.088

A THERMAL SET FOR MEASUREMENT OF TEMPERATURES OF 1100 TO 1300°C WITH AN ERROR OF 1°C

SOVREM. METODY I PRIBORY AVTOMATICH. KONTROLYA I REGULIR. TEKHNOL. PROTSESSOV in Russian Moscow 1976 pp 69-73

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 12, 1976 Abstract No 12.32.958]

SACHENKO, A. A., and KOCHAN, V. A.

[Text] In the electronics industry in the technological process of diffusion, one necessary condition of high quality reproducibility of parameters of integrated microcircuits and semiconductor devices is testing and measurement of temperatures in the range of 1100° to 1300°C in electrothermal installations with errors of ± 0.5°C. A spread of temperature control within this range of $\pm(2\text{-}3)$°C may result in rejection of products. A study is made of the possibility of using the most accurate of the series-produced automatic potentiometers for this purpose, for example the type KSP4 of 0.25 accuracy class in combination with a thermoelectric thermometer such as the PP-1 calibration thermometer. Figure 1; references 7.

USSR UDC 534.647

A LOW FREQUENCY VIBRATION MEASURING APPARATUS

VIBRATSION. TEKHNIKA in Russian Moscow 1976 pp 45-48

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 12, 1976 Abstract No 12.32.594 by P.N.A.]

MOSKALIK, L. M., CHERNOV, A. A., and FROLOVA, I. YE.

[Text] A 10-channel vibration measuring semiconductor apparatus, the type 10VP-2, is described, designed for measurement of the parameters of vibration with studies of dynamic characteristics of structures. The apparatus allows measurement of vibration displacements, velocities and accelerations in the 1-200 Hz frequency range. The 10VP-2 apparatus consists of a 10-channel unit of amplifiers, including also a testing unit and power supply. The output parameters of the apparatus are: voltage 5 V, load impedance 1 Kω; current -- 30 mA with load impedance 10 ohm. Figures 2; table 1.

USSR UDC 620.1.05:531.24

A STAND FOR DETERMINING MOMENTS OF INERTIA OF SOLIDS OF DIFFERENT SHAPES

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 40, 30 Oct 76 pp 114-115 Author's Certificate No 533845 filed 25 Mar 74

DMITRIYEVSKIY, V. A., BELOMOIN, V. A., and KRUCHININA, V. V.

[Text] This Author's Certificate introduces a stand for determining moments of inertia of solids of different shapes by the physical pendulum method. The stand contains a support beam to which a rocker frame is connected. The frame carries brackets and turnbuckles for holding and moving the test solid in the vertical plane. The stand also includes a mechanism for horizontal displacement of the frame and a balance weight that is fastened to the frame on one of the brackets. As a distinguishing feature of the patent the work involved in determining the moments of inertia of solids of revolution relative to three mutually perpendicular axes is reduced and measurement accuracy is improved by making the rocker frame in the form of a cross rail set on prisms and a U-shaped suspension. The cross rail and suspension are connected together by a rotating shaft.

USSR

UDC 535.241.41

A METHOD OF DETERMINING THE INTENSITY OF MONOCHROMATIC LINE EMISSION

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 40, 30 Oct 76 p 113 Author's Certificate No 533836 filed 30 Dec 74

VAYNRIB, YE. A., VERTUSHKIN, V. K., KABANOV, G. L., and KISELEV, M. I.

[Text] This Author's Certificate introduces: 1. A method of determining the intensity of monochromatic line emission based on using optical emission stimulated in the atoms of a gas by an electron beam. As a distinguishing feature of the patent the intensity of emission of each spectral line is determined in absolute energy units by communicating an energy below the ionization threshold to the electrons that stimulate the emission, and by using a technique such as the "retarding" potential method to determine the total number of electrons that stimulate all radiative levels of the given atoms in a unit of time, after which the emission of each spectral line is directed to a photocell and the response of the cell is determined; the electron energy is then changed so that it is lower than the ionization threshold by a factor equal to the number of spectral lines stimulated in the gas, the total number of electrons and the response of the photocell being determined for each individual spectral line. The intensity of each spectral line is then determined from the results. 2. A modification of this method distinguished by the fact that only those spectral lines formed during the lowest transition are directed to the photocell. 3. A modification of this method with the distinguishing feature that the emission of all spectral lines is directed simultaneously to the photocell, and the response of the cell to the total radiation is determined. The sensitivity of the photocell to the emission of each spectral line in the source used is then found from the results. With the addition of application No 2096886/26-25.

USSR UDC 681.333.519.2

AN OPTICAL CORRELOMETER

OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 42, 1976 p 118 Item No 535578

GERASIMUK, L. N., POCHERNYAYEV, I. M., and GERASIMUK, V. N.

[Text] An optical correlometer containing a cathode ray tube with a thermoplastic transparent target and an optical inlet window, on the axis of which a laser, electronic-optical (magnetic-optical) modulator and collimator are located in series, while a direct Fourier transform lens, complex-conjugate filter, reverse Fourier transform lens and photographic recorder are located on the output optical axis of the cathode ray tube, is distinguished by the fact that to increase the accuracy of operation under conditions of extreme vibration, the correlometer contains a source of noncoherent light, a half-silvered mirror, first and second light filters, a light guide, photoreceptor and matching unit, the output of which is connected to the controlling input of the electronic-optical (magnetic-optical) modulator, while the input is connected to the output of the photoreceptor, located on the output optical axis of the cathode ray tube before the reverse Fourier transform lens and behind the first light filter, located behind the light guide, the intake of which is located in the plane of the complex-conjugate filter behind the second light filter, the half-silvered mirror is located on the optical axis of the optical inlet of the cathode-ray tube and is optically coupled to the source of noncoherent light, the spectrum of which does not overlap the radiation frequency of the laser.

USSR UDC 531.74.082.5

ANALYSIS OF USING OPTICO-MECHANICAL COMPENSATORS IN AUTOMATIC OPTICO-ELECTRONIC GONIOMETER SYSTEMS

Leningrad MATERIALY VSESOYUZNOY NAUCHNO-TEKHNICHESKOY KONFERENTSII. SOVREMENNAYA PRIKLADNAYA OPTIKA I OPTICHESKIYE PRIBORY [Materials From the All-Union Scientific-Technical Conference. Modern Applied Optics and Optical Instruments, Collection of Works] in Russian, Part 3, 1975 pp 12-13

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 9, 1976 Abstract No 9.32.330 by P.N.A.]

YAKUSHENKO, YU. G., and YELIZARENKO, A. S.

[Text] The authors study an optico-electronic goniometer system for monitoring the taper of transparent plates (OESM). The functional

diagram of the OESM system is given which operates by the collimation method. The operating principle of the OESM system is similar to the operating principle of amplitude-phase optico-electronic goniometers. The range of measurable angular deflections is ± 20 C^{II}; the mean square error of measuring the angle is ± 0.3 C^{II}. Figures 1; references 2.

USSR UDC 621.382

AN ELECTRO-OPTICAL DEVICE

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 40, 30 Oct 76 p 154 Author's Certificate No 534036 filed 25 Jun 75

SMERTIN, V. G., Moscow "Order of Lenin" Aviation Institute imeni Sergo Ordzhonikidze

[Text] This Author's Certificate introduces an electro-optical device that contains an optron with positive feedback. The radiation source and receiver of the optron are shunted by radiation receivers optically coupled to controlling radiation sources. As a distinguishing feature of the patent the functional capabilities of the device are extended by adding a delayed feedback channel that contains a radiation source optically coupled to a photocell connected in series with one of the controlling radiation sources, which in turn is connected in series with the optron radiation source.

USSR UDC 621.575:662.767:620.92

AUTONOMOUS DEVICE FOR DEVELOPING COLD AND ELECTRIC POWER AT A GAS FIELD

Krasnodar TRUDY KRASNODARSKOGO POLITEKHNICHESKOGO INSTITUTA [Works of the Krasnodar Polytechnic Institute] in Russian No 72, 1976 pp 21-24

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 10, 1976 Abstract No 10S120 by V. A. Speysher]

PEREZHOGIN, L. A., and BEZZABOTOV, YU. S.

[Text] A scheme has been developed for heat-utilizing refrigeration devices for the simultaneous development of electric power and cold, operating on the turbine-compressor principle and using the chemical energy of steam generators. The devices utilized containers with air cooling and block automated refrigeration machinery of the KhM-FFU-80 type. The temperature of the coolant in the forward cycle of the turbine must not exceed 420°K, as a consequence of which the supply of heat to the forward cycle evaporator is accomplished by an intermediate heat carrier (tetracresyloxysilane). The energy developed by the turbine in the forward cycle is expended in driving the refrigerator compressor and the electric generator which are connected with the shaft of the turbine with the aid of couplings. Figures 2; references 5.

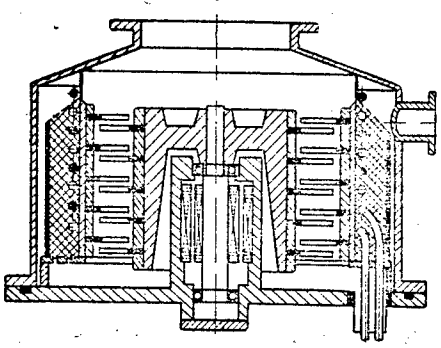
USSR UDC 621.527.8

A TURBOMOLECULAR VACUUM PUMP

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 40, 30 Oct 76 p 95 Author's Certificate No 533757 filed 5 Apr 73

TUZANKIN, YU. M., and BELYAYEV, L. A.

[Text] This Author's Certificate introduces: 1. A turbomolecular vacuum pump that contains a housing holding a rotor and a cooled stator. As a distinguishing feature of the patent the ultimate vacuum is increased while losses of electric power and coolant are decreased by enclosing the stator in a thin-walled cylinder carrying tubing for the coolant and heating elements on the outside surface. 2. A modification of this pump distinguished by the fact that the space between the housing and the cylinder is filled with a sorbent and confined by perforated partitions that form gaps with the housing.



USSR UDC 621.187.128:628.165.094.004.2

USE OF SULFUR COAL MECHANICAL FILTERS ON POWER SETS OF THERMOELECTRIC POWER PLANTS

TRUDY VSESOYUZNOGO TEPLOTEKHNICHESKOGO NII [Works of the All-Union Heat Engineering Scientific Research Institute] in Russian No 9, 1976 pp 115-117

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 9, 1976 Abstract No 9R103]

KHODYREV, B. N.

[Text] Based on the results of investigating 18 thermoelectric power plants of the Ministry of Energy USSR an analysis was made of the effectiveness of using mechanical sulfur coal filters. The existence was established at the power plant of a great diversity in technological means of regenerating sulfur coal (10 modifications at 11 thermoelectric power plants), significant fluctuations in the specific consumption of water for regenerating the filtering load (from 15 to 78 m^3 per 1 m^3 of material). The effectiveness of deferrugination of the condensate varies from 20 to 66% and depends on the Fe concentrate in the original condensate and the regeneration technology used for the sulfur coal. This situation confronts investigators with the problem of developing a single, sufficiently argued and economic technology for restoring the filtering capacity of sulfur coal.

USSR UDC 626.833:620.197.6

USE OF COMBINATION POLYMER COATINGS TO PROTECT IRRIGATION PUMPS FROM CAVITATION EROSION

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian pp 26-28

KATS, I. M.

[Abstract] A description is given of experiments on the use of combinations of polymer coatings to protect the rotor blades of large irrigation pumps from cavitation erosion. Results of laboratory experiments and initial field tests demonstrate the technological feasibility and promise of this method. The 32D19 pump used in the experiments has a pumping capacity of 5,000 m^3/hr, a 30-meter head, 730 rpm, rotor dia 740 mm. The test water simulated field conditions: high salt and abrasives content, minerals with hardness > 5 on the Mohs scale, 15-20 kg/m^3, dia of solids 0.25-0.50 mm. The area of maximum cavitation on the blades were coated with a 1-3-mm layer of epoxy-zinc base without solvent plus a main epoxy thermoplastic layer with high elasticity. Tests showed 10-15-mm erosion in the peripheral areas only, with 80-85% of the coating intact, whereas blades without the coating had 50-75% wear. More experiments are needed to determine the expected life of blades with the coatings. Ill 2; biblio 2.

USSR UDC 621.355.1

GAP IRREGULARITY IN THE CRANK BEARINGS AND CONNECTING-ROD BEARINGS OF THE ZMZ-53 ENGINE CRANKSHAFT

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 10, 1976 pp 9-12

NAZAROV, A. D., TSOY, YE. A., and GRIGOR'YEV, YE. A.

[Abstract] Analysis of data on 33 ZMZ-53 engines at first overhaul showed that the average gap in the crank bearings of the crankshaft amounted to 150-210 μ for a distribution of 120-300 μ. The average gap of the crank bearing journal was 2.52 times that of the connecting-rod journal. Test conducted with a Danish vibration tester showed that at 3,200 rpm rates load and 246-μ crank bearing gap the transition from idle to rated load had practically no influence on the vibration spectrum of the parts of the engine housing, except for certain components in the medium frequency range where the vibration rate was observed to increase one or two decibels. For a 275-μ crank-bearing gap the rate of vibration of the same engine parts increased 4-12 decibels over the entire frequency

range. Additional test results are discussed, all of which indicate that gap irregularity, particularly in the journals and bearings, has a greater effect on engine operation impairment than the average gap. For example, reducing the gap irregularity factor from 1.48 to 1.08 and from 1.32 to 1.03 for the crank and connecting-rod bearings, respectively, would amount to increasing the average respective gaps from 195 to 246 μ and from 218 to 275 μ, which would reflect a 26% increase in the service life of the two types of crankshaft bearings in the ZMZ-53 engine. Ill 5; tab 4; biblio 3.

USSR UDC 533.6.07

FREE MOLECULAR AERODYNAMIC DEVICE OF ION-PLASMA TYPE WITH CRYOGENIC PUMPING

Novosibirsk VSESOYUZNYY SIMPOZIUM PO METODAM AEROFIZICHESKIKH ISSLEDOVANII [All-Union Symposium on Methods of Aerophysical Investigations, Collection of Works] in Russian, Texts of Reports, 26-29 Apr 76 p 31

VELIKANOV, YE. R., KNIVEL', A. YA. and OMELIK, A. I.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 9 1976 Abstract No 9B1104 from the texts]

[Text] In the device the working gas (nitrogen) goes from the system of gas supply to the ionization chamber where it is ionized in a high-frequency field and travels to the acceleration chamber. Part of the plasma, accelerated by the field of natural volume charge, enters in the form of a free molecular stream into the working chamber pumped by a cryogenic pump. The remaining gas flows to the chamber for separation and is pumped by a moderate vacuum capacity. The center of the accelerated flow is about 4 cm, the velocity ratio S is approximately 10, the velocity v = 10-40 km/sec, the intensity j is approximately equal to 10^{15} 1 cm^2. sec. The vacuum system of the working chamber is a cryogenic pump fed from the KhGU-500/15 device.

USSR

VACUUM SYSTEM OF THE EXPERIMENTAL TM-4 THERMONUCLEAR REACTOR

Leningrad DOKL. VSES. SOVESHCH. PO INZH. PROBL. UPRAVLYAYEM. TERMOYADER. SINTEZ in Russian Vol 1, 1975 pp 174-183

[From REF ZH 50. YADERNYYE REAKTORY No 8, 1976 8.50.223]

VAKHRUSHIN, YU. P., IZOTOV, YE. N., ODINTSOV, V. N., SAKSAGANSKIY, G. L., SEREBRENNIKOV, D. V., and FEFELOV, P. A.

[Text] The distinctive feature of the TM-4 reactor is that the discharge chamber is in "hot" state during operation, its temperature is maintained at 1,000°C. Requirements imposed on the vacuum system of the TM-4 are discussed. Alloy EI-435 is used as material for the discharge chamber. Heat-insulating screens are made of heat-resistant alloy TsM-10. Illus 5; ref 4.

USSR

VACUUM SYSTEM OF THE TOKAMAK-10 THERMONUCLEAR REACTOR

Leningrad DOKL. VSES. SOVEHSH. PO INZH. PROBL. UPRAVLYAYEM. TERMOYADER. SINTEZA in Russian 1974 pp 150-164

[From REF. ZH. 50. YADERNYYE REAKTORY No 8, 1976 80.50.224]

SIMONOV, V. A., KOLLEROV, E. P., MASLENNIKOV, YE. A., ORLOV, P. YE., POPKOV, G. N., and ROYENKO, V. A.

[Text] Requirements for the vacuum process treatment of the walls of the T-10 discharge chamber are analyzed. Components of the vacuum system are described. These must ensure maximum evacuation of up to $1 \cdot 10^{-9}$mm Hg. The set of equipment used for remote control and monitoring of the vacuum system is examined. Illus 9; tab 2.

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